IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXV OCTOBER 1946

ARNAUD (G.). **La 'gale noire' ou 'galle verruqueuse' de la Pomme de terre.** ['Black scab' or 'warty gall' of Potato.]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 89–98, 1942. [Received April, 1946.]

The only satisfactory method of arresting the spread of potato wart disease (*Synchytrium endobioticum*) in France [*R.A.M.*, xv, pp. 311, 601] is by the general use of resistant varieties. Intensive cultivation for seed-selection purposes should be carried out with such resistant varieties as Belle de Fontenay, Juli, Étoile du Léon, Ackersegen, Ostbote, Furore, and Parnassia. The same varieties should also be imported (with due care), together with Krebsfest, Kaiserkrone, Feuergold, Pepo, Sickingen, and Max Delbruck, which are not at present widely grown. These imported tubers should be planted in isolated localities suitable for selection work (e.g., mountainous areas), and after one year's rigorous sanitary control the produce should be dispatched to large propagation centres. The cultivation of susceptible varieties should be forbidden, beginning in those parts of France adjacent to the north and north-eastern frontiers, and then in other areas where foci of infection are known to exist or are discovered. Careful watch for infected tubers should be kept at harvest in localities near those known or suspected to be infected, and if the disease is found, the area should be declared a contaminated zone and special precautions taken.

AIYAR (S. P.). **The effects of phosphate deficiency on Rice.**—*Proc. Indian Acad. Sci.*, Sect. B, xxiii, 4, pp. 165–193, 2 pl., 7 graphs, 1946.

The low rice yields produced at the Kelington Seed Farm, Yedashe, Central Burma, having been attributed to phosphate deficiency, pot, field, and solution culture experiments were carried out to determine the effects of phosphorus starvation and phosphorus treatments on seedlings. Characteristic symptoms of the shortage of this element included general stunting, reduction in tillering, bunching of the leaves, a dark or blue-green tinge, and (in solution cultures) a lack of branching and remarkable elongation of the primary roots, which were deep reddish-brown in contrast to the white of fully manured plants. In the field the crop remained green at maturity. Satisfactory yield increases were obtained by the joint application of phosphorus and nitrogen, while the use of the former alone resulted in a more modest improvement. In the field the application of 2 cwt. of bone meal per acre is recommended.

KHRISTOV (A.). Гъби причиняващи петносването на маковитѣ кутийки и плесеняването на тѣхнитѣ семена. [Fungi causing spots on the balls, and moulding the seed of Opium Poppy.]—*Спис. Земед. Опит. Инсти, България* [*J. agric. Exp. Stas Bulgaria*], xiii, 1/2, pp. 13–19, 4 figs., 1943. [English summary. Received December, 1945.]

An examination of opium poppy (*Papaver somniferum*) balls from three different areas in Bulgaria during the years 1926 to 1932 showed the following fungi

as causal agents of spotting and seed infection. *Peronospora arborescens* [*R.A.M.*, xxi, p. 99] under favourable conditions attacked poppy balls throughout the vegetation period, causing premature withering or abnormal development. *Pleospora calvescens* [ibid., xxiii, p. 120] annually causes more or less severe losses. In humid conditions the hyphae on the spots penetrate inward, causing moulding of the seed [ibid., xi, p. 475]. *Alternaria brassicae* var. *somniferum*, first noted in Bulgaria in 1909, has since been observed in the Sofia and other areas on *Papaver somniferum* and in the former on *P. orientale*. This semi-parasitic fungus primarily attacks poppy plants towards the end of the vegetation period, causing dry, irregular, yellow to greyish-brown spots, dark to pale yellow at the circumference. There have been cases where the fungus appeared early and caused considerable damage. The pathogenicity of the fungus was established by inoculations on plants at various stages of growth, the incubation period being six days, and the fungus was successfully reisolated. *Fusarium scirpi* var. *caudatum* [ibid., xii, p. 493], parasitic on the roots of sweet potato, has been reported as semi-parasitic on opium poppies in Bulgaria. Infected leaves displayed precocious growth, at first developing whitish-yellow, ill-defined spots, which sometimes became brown at the centre. On the stems the elongated spots were ill defined, light yellow to brown, occasionally turning to brown or dark brown. This fungus is frequently encountered under field conditions, causing spotting of poppy plants and moulding of their seed. The dry, rounded, yellow to greenish-brown spots frequently coalesce and embrace the whole upper part of the plant. Seed from infected plants sown in sterilized soil yielded stunted seedlings, which assumed a reddish-brown colour at the base. The fungus affects the hypocotyls and cotyledons, on which whitish-brown to brown spots appear. *Hormodendrum cladosporioides* [ibid., xviii, p. 84; xxi, p. 531], a form of *Mycosphaerella tulasnei*, with spores measuring 7·5 to 24 by 2·5 to 6·6 μ, usually uni-, rarely quadricellular, was isolated from poppy seeds, the lower leaves of plants grown from infected seed being attacked and becoming yellow-brown at the base. *Ophiobolus sativus* causes the formation on poppy leaves of small, dry, round to polygonal spots, grey at first, becoming brown to dark brown in the centre at maturity and finally surrounded by a dark, oily, brownish-green halo. The conidiophores measured 37 to 88·5 by 19·5 to 26·5 μ and were 3- to 8-septate, developing on characteristic markedly articulate conidiophores. In form, dimensions, septation, and variation, the *Helminthosporium* state was fully consonant with *H. sativum* and inoculations of barley with the poppy isolate gave positive results.

On rare occasions the following organisms showed limited pathogenicity to poppy plants: *Macrosporium bresadolae* [ibid., iv, p. 313], *Fusarium* sp., *Trichothecium roseum*, *Sclerotinia* sp., *Rhizopus* sp., *Penicillium* sp., and *Mucor mucedo*.

Control measures recommended are destruction of stubble of the former poppy crop, use of disease-free seed, seed disinfection with 0·05 per cent. mercuric chloride for one hour or 0·25 per cent. formaldehyde for 15 minutes, and spraying the plants, especially the balls, with 1 per cent. Bordeaux mixture and resin soap.

Cristinzio (M.). **Una grave malattia del Ricino (Ricinus communis L.) in Provincia di Napoli.** [A serious disease of Castor Oil (*Ricinus communis* L.) in the Province of Naples.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 83–92, 2 pl., 1 fig., 1942. [Received April, 1946.]

During 1939, castor oil (*Ricinus communis*) growing in three localities near Naples showed the presence of a disease [*R.A.M.*, xvii, p. 135] which caused slight loss. In 1940 it became more prevalent, and in 1941 a high percentage of plants was killed off. The variety mainly affected was Minore, which had been grown on a large scale for many years; on the recently introduced Sanguigna the attack was less severe.

Blackish spots, with marked indentations, and extending frequently from the base of the stem to the tips of the branches, began above the collar and spread

upwards. Sometimes, only one branch was affected at first, though the others withered later as a result of parasitism localized in the stem. The diseased branches were contorted, bent over towards the ground, and bore few, small, chlorotic leaves with pinched inflorescences. Light red pustules or, in rainy weather, a white mycelial rot, later developed on the spots.

According to the growers, the disease appeared when the young plants showed only two or three leaves. Sowings made early in April showed on 13th June in some plantings, 30 per cent. of the plants already dead or withered. Early infections can prove fatal in only two or three days. From the symptoms of the disease and the microscopic characters of the mycelium and conidia the author attributes the disease to *Fusarium sambucinum* [*Gibberella pulicaris*: ibid., xviii, p. 760; xxv, p. 331]. Outbreaks were closely related with seasonal conditions, the nature of the soil, and cultural practices, assuming epidemic proportions after wet periods, whereas in dry weather they tended to disappear. If wet conditions recurred the plants again wilted and finally succumbed. The local soils and flood method of irrigation undoubtedly favour early infections. The disease was probably introduced into the Campagna on seed from northern Italy.

Control lies chiefly in prevention; the burning of infected plants, thin sowings without intercropping, improved irrigation methods, the use of healthy or treated seed, a two-years' rotation at least, the avoidance of excessive applications of organic fertilizers, chemical fertilizers, especially calcium cyanamide, being used, and the adoption of resistant varieties. In very wet seasons the young plants should be sprayed once or twice with 1 per cent. Bordeaux mixture or 2 per cent. calcium polysulphide.

CAMINHA (A.). **A enfermidade do mosaico na Baía.** [The mosaic disease in Bahia.]—*Brasil açuc.*, xxi, 6, pp. 67–72, 2 figs., 1943. [Received April, 1946.]

In the course of a tour of inspection of over 50 sugar-cane plantations in the State of Bahia, the author observed widespread infection by the mosaic virus, generally in a mild form which need cause no immediate alarm. Certain old varieties, however, such as Bois Rouge, Demerara 625, Salangor, Creoula, and Pitú, are highly susceptible and should be excluded from future plantings. Attention is drawn to the possibility of changes in the normal reactions to mosaic of varieties transplanted to a new habitat, cases in point including P.O.J. 213, which is susceptible in its place of origin and also in Pernambuco, Brazil, but virtually immune in Argentina, resistant in São Paulo, and tolerant in Rio; H. 709, absolutely immune in Hawaii, is extremely susceptible elsewhere; B.H. 10 (12), practically immune in Barbados and British Guiana, shows exaggerated susceptibility in Brazil; Cayenne 10, highly resistant in British Guiana, immediately develops tertiary symptoms of mosaic in Rio; the above-mentioned Demerara 615 is perfectly healthy in British Guiana and in Pernambuco and Alagoas, Brazil, but in Rio it has had to be discarded on account of its susceptibility to mosaic, and a similar course must be recommended for Bahia; and Coimbatore 281, highly susceptible in its native habitat, acquires a marked degree of resistance in São Paulo. Finally, a strict watch should be kept on the ordinarily resistant Co. 290, which occupies 70 per cent. of the total area under sugar-cane in Bahia and has shown disquieting signs of susceptibility. To guard against a possible collapse of this variety the cultivation of the highly resistant P.O.J. 2878 should be extended to cover at least 80 per cent. of the whole area.

CAMINHA (A.). **A molestia das listas vermelhas.** [The red-stripe disease.]—*Brasil açuc.*, xx, 5, pp. 507–509, 1 fig., 1942. [Received April, 1946.]

Red stripe of sugar-cane (*Phytomonas* [*Xanthomonas*] *rubrilineans* and *P. rubrisubalbicans*) [*R.A.M.*, x, p. 128] was first recorded in Brazil by the author at

Campos, State of Rio [ibid., xvi, p. 127], in 1931, and in the following year the loss from this source in some of the regional plantations amounted to 30 per cent. and upwards of the normal yield per ha. At the same time A. Müller confirmed the presence of the disease in Minas Gerais, and reports from Mato Grosso point to its existence in that State also. Besides the widely grown P.O.J. 2878 variety, P.O.J. 2714, 2725, 2727, 213, 228, and 36 are highly resistant to red stripe, while resistance or tolerance has been shown by P.O.J. 979 and 105, Co. 213, 281, and 290, Kassoer, and Uba. The cultivation of resistant varieties is the best and most economical method of combating red stripe. Roguing of infected stools may be practised with advantage in the early stages of the disease, but in cases of advanced contamination a bi- to triennial rotation with leguminous cover crops is recommended, suitable species including *Calopogonium mucunoides*, *Pueraria javanica*, *Indigofera hendecaphylla*, *I. hirsuta*, *Centrosema pubescens*, and *Crotalaria usaramoensis*.

Arruda (S. C.). **As doenças da Cana de Açucar no Estado de São Paulo.** [Sugar-Cane diseases in the State of São Paulo.]—*Biológico*, xi, 12, pp. 309–315, 4 figs., 1945; xii, 5, pp. 133–134, 3 figs., 2 diags., 1946.

The two most important sugar-cane diseases in São Paulo, Brazil [*R.A.M.*, xxv, p. 279], are leaf scald (*Phytomonas* [*Xanthomonas*] *albilineans*) and mosaic. Of the eight varieties cultivated on a commercial scale in the State, three are resistant to leaf scald, viz., C.P. 27/139, Co. 290, and F. 29/7, two tolerant, P.O.J. 2727 and P.O.J. 2878, and three susceptible, P.O.J. 213, Co. 281, and C.P. 29/320.

Both diseases may be combated by the same methods, i.e., the cultivation of resistant varieties and the production of healthy setts. Steps have already been taken to provide rigorously selected material of the resistant Co. 290 variety (which occupies over half the total area under sugar-cane in São Paulo) for propagation. Nurseries should be located at a distance from the ordinary cane fields, or if this is impracticable, in the vicinity of the mosaic-resistant varieties. Directions are given for the disinfection of the cut ends of the setts with a strong solution of creolin (against *X. albilineans*); for planting, which should be carried out from the middle of January to the middle of February, leaving a space of 30 to 50 cm. between each sett; and for the inspection service and roguing operations. Seven inspections should be made between May and November.

Observations were made in 1944–5 on the spread of mosaic in two regions, one pre-eminently adapted to cane-growing (Piracicaba) and the other unsuitable for this purpose (Campinas). In the former, where the widely grown, susceptible Co. 290 acts as a prolific reservoir of infection, the incidence of secondary infection ranged from 4·8 to 6·4 per cent. compared with only 0·8 to 1·2 in the latter.

Besides the immediate advantage of increased yields resulting from the selection of healthy setts, amounting to 14 per cent. in one test on Co. 290, the regular inspection service affords a safeguard against the dispersal of new diseases, which may be localized or even eradicated by timely control measures. A case in point is that of red stripe [*X. rubrilineans*: see preceding abstract], which was detected on only two stools out of 4,200 in a first-year nursery.

Pickel (B.). **O mal da raiz da Cana de Açucar.** [Sugar-Cane root rot.]—*Brasil Açuc.*, xxi, 1, pp. 94–100, 1943. [Received April, 1946.]

The writer summarizes the principal contributions to the literature of sugar-cane root rot and discusses the two theories that have been advanced to explain its etiology, viz., (1) root asphyxiation due to defective soil aeration, and (2) infection by parasitic fungi. Under Pernambuco conditions, the poor quality and unsuitable structure of the soil are the main factors in the development of root rot, but *Himantia stellifera* [*R.A.M.*, xxi, p. 246; xxv, p. 363] is responsible for considerable secondary damage. The disease is incurable and can only be combated by

prophylactic cultural methods designed to maintain the root system in a vigorous condition promoting rapid growth [ibid., xxv, p. 233].

Bitancourt (A. A.). **A probit scale for slide rules.**—*Biometr. Bull.*, i, 4, pp. 46–47, 1 graph, 1945.

In studies of the frequency distribution of the length and width of different species of fungal spores, the writer has made extensive use of a modification of C. I. Bliss's graphic probit method, originally devised for the analysis of toxicological experiments (*Ann. appl. Biol.*, xxii, pp. 134–167, 1935; xxiv, pp. 815–852, 1937) involving, (1) measurement of the spore dimensions either with an ocular micrometer or by the application of a metric ruler to the projected image, the spore, or its photograph, (2) entry of the reading on a tally sheet to obtain a frequency distribution, (3) cumulation of the frequencies, (4) calculation of the percentage cumulated frequencies, and (5) conversion of percentages to probits by a table. Steps (4) and (5) were combined by the author into one operation with a slide rule carrying a probit scale.

Wehmeyer (L. E.). **Studies on some fungi from north-western Wyoming. I. Pyrenomycetes.**—*Mycologia*, xxxviii, 2, pp. 144–170, 20 figs., 1946.

Twenty-four species of Pyrenomycetes on stems of 70 different hosts, representing 115 collections made in seven localities of the Jackson region of the Rocky Mountains in 1940, are described.

As regards the genus *Mycosphaerella*, which has no obvious limitation of host, it is held that little practical value attaches to description on the basis of host occurrence. The writer has endeavoured, therefore, to marshal his material in such a way as to provide opportunity for later reference, rather than obscuring it under the names of new species or misdeterminations. In the first of two tables his collections are arranged according to spore size, and lines are employed to indicate probable species groups; and in the second many collections having certain common characters are similarly presented and referred to the collective species *M. tassiana*.

M. hypodermellae n. sp. was observed on the surface of living needles of *Pinus murrayana* as linear lesions of the epidermis, 100 to 300 μ in length, through which emerged a minute, granular stroma or a linear cluster of vertical setose hyphae. Globose perithecia, 90 to 100 μ in diameter, with walls of coarse, black parenchyma 25 to 35 μ thick, were scattered singly or in lines, embedded in the foliar tissue with their tiny, papillate ostioles emerging through a common rupture, often with a cluster of vertical, setose conidiophores 5 to 6 μ in diameter. The asci were dense and fasciculate, broadly clavate, 70 by 21 μ, elongating to 85 to 90 by 17 to 18 μ at maturity; the spores biseriate, clavate-ellipsoid, bicellular, colourless, the upper end rounded, and tapering towards the base, 13 to 16 by 3·5 to 5 μ.

This fungus occurred on older, rather discoloured needles infected by *Hypodermella concolor*. Dark-brown, septate hyphae abounded in the hysterothecia of *H. concolor* or immediately below the epidermis and formed small stromatic masses which gave rise to the vertical, densely septate, brown conidiophores, 5 to 7 μ in diameter and 85 to 100 μ long, of the *Scolecotrichum* stage. They bore brown, ellipsoid, bicellular conidia, measuring 17 to 18 by 7 μ long, deciduous and seldom seen attached. The ascus and conidial stages both resemble *M. tassiana*, but are more regularly clavate and the perithecia more globose, and embedded in longitudinal rows in this species. This collection resembles most *M. abietis*, of which Rostrup regarded *Phoma abietis* and *Toxosporium abietinum* as conidial stages. *M. peckii* on hemlock [*Tsuga*] cones, and *M. pinsapo* and *M. pinicola* on fir and pine needles, respectively, are similar but have smaller spores.

H. concolor produced scattered hysterothecia on the upper surface of the living parts of the previous year's leaves of *Pinus murrayana*, the tips of which were

brown and dry. This fungus is referred to *H. concolor* although the spore dimensions are smaller (40 to 44 by 2·5 to 3·5μ) than those given by Darker [*R.A.M.*, xii, p. 254]. Secondary fungi found on the same needle were a *Hendersonia* sp., apparently parasitic and similar to *H. acicola* [ibid., xvii, p. 570], the *M. hypodermellae* described above with *Scolecotrichum* (? its conidial stage), and tiny pycnidia of a *Ramularia*, the three last being considered as active pathogens of the hysterothecia of the *Hypodermella*.

Overholts (L. O.) & Lowe (J. L.). **New species of Poria.**—*Mycologia*, xxxviii, 2, pp. 202–212, 2 figs., 1946.

The following seven species of *Poria* producing decays in timbers are believed by the authors not to have been described before, and are accordingly proposed as new: *P. alutacea* Lowe on the wood of coniferous and deciduous trees, *P. carbonica* Overholts on dead and often charred wood of conifers, *P. fissiliformis* Pilát *in litt.* on the wood of deciduous trees, *P. illudens* Overholts & Lowe on the wood of conifers and, less often, deciduous trees, and *P. lenta* Overholts & Lowe, *P. mappa* Overholts & Lowe, and *P. rubens* Overholts & Lowe, all three on the wood of conifers.

Seaver (F. J.) & Waterston (J. M.). **Contributions to the mycoflora of Bermuda. IV.**—*Mycologia*, xxxviii, 2, pp. 180–201, 8 figs., 1946.

With this, the fourth contribution to the mycoflora of Bermuda [*R.A.M.*, xxii, p. 113], the number of named species recorded to date reaches a total of over 750, representing 310 genera. The number of endemic species is small and less than 7 per cent. of the total.

The present annotated list of 40 fungi includes *Macrophoma lilii* n. sp. on dead stems of *Lilium longiflorum*, and two other new species. Interesting fungi recorded include *Entomophthora virescens* parasitic on larvae of cutworms (*Feltia subterranea*) and *Claviceps paspali*, the finding of the sphacelial stage on the inflorescence of *Paspalum dilatatum* constituting a new record for the Islands.

Dodge (B. O.). **A curious fungus on Opuntia.**—*Bull. Torrey bot. Cl.*, lxxiii, 3, pp. 219–223, 2 figs., 1946.

Small fruiting bodies of a fungus found on the pads of the cactus *Opuntia ammophila* in Florida, and new to the author, are described as consisting of two parts, a stalk and a cap. The stalk is dark brown, about 200 to 500 μ in length, tapering from about 40 μ in diameter at the base to about 20 μ at the top, and is composed of up to ten easily separable joints. The dark-brown, almost black, caps, measuring 50 to 80 μ in diameter, 20 to 25 μ in thickness, and rather concavo-convex in shape, are easily dislodged and often come to rest on the cactus pads. The outer covering of the cap is chitinous, hard, and brittle, and appears perforated, but whether these scattered spots represent holes or only thin places is doubtful.

Pure cultures of the fungus were readily obtained from the cap. Unjointed stalks, a few with typical caps, growing from small aggregations of mycelium appeared after three or four weeks. The cap is considered to serve as an organ of propagation.

The fungus is named *Tretopileus opuntiae*, but its systematic position is not known.

Castellani (E.). **Osservazioni su casi di antibiosi tra Demaziacee ed un Uredinale.** [Observations on cases of antibiosis between Dematiaceae and a member of the Uredinales.]—Reprinted from *Riv. Pat. veg.*, xxxii, 7–8, 11 pp., 1 fig., 1942. [Received February, 1946.]

On leaves of *Rhus villosa* collected in Eritrea the author observed in many sori of *Hemileia rhois* an *Alternaria* displaying marked antibiotic action. The latter

fungus had completely invaded the rust spots, imparting to them a black, cottony appearance. On the lower leaf surface, from the rust spot emerged short conidiophores 5 to 7 μ wide, bearing chains of ellipsoidal, cylindrical, or obclavate conidia, beaked at one end, 16 to 25 μ long and 6 to 12 (average 10) μ wide, and usually with three transverse and one or two longitudinal septa. The development of the *Alternaria* was much more rapid and abundant than that of *H. rhois*, the sporophores of which it submerged as they appeared through the stomata. The effect was markedly unfavourable to the rust, the uredospores of which developed in smaller numbers and were less turgid than in the unattacked sori.

The *Alternaria* apparently belongs to the *A. tenuis* group. It cannot be regarded as a true hyperparasite. The mycelium penetrated the leaf tissues of *R. villosa*, and acting synergetically accelerated and increased the necrosis of the tissues begun by the rust, which had brought about the conditions necessary for infection by the *Alternaria*, a very weak parasite. The progress of *H. rhois*, an obligate parasite, was impeded or inhibited by a barrier of dead tissue round its own infection site, caused by the *Alternaria*.

The humid conditions prevailing at the time (over 90 per cent. humidity at certain hours) were more favourable to the development of saprophytes than of obligate parasites of plants.

KARLING (J. S.). **Brazilian Chytrids. IX. Species of Rhizophydium.**—*Amer. J. Bot.*, xxxiii, 5, pp. 328–334, 37 figs., 1946.

This further study of the Brazilian Chytrids [*R.A.M.*, xxiv, p. 504] treats of twelve species of *Rhizophydium* recovered from water and moist soil samples obtained in the Amazon Valley. *R. hyperparasiticum* n. sp., *R. mycetophagum* n. sp., and *R. carpophilum* are hyperparasites of soil Chytrids, *Choanephora* sp., and Oomycetes, respectively; and *R. amoebae* n. sp. and *R. apiculatum* n. sp. of microscopic animals.

JOHNSON (E. M.) & VALLEAU (W. D.). **Field strains of Tobacco-mosaic virus.**—*Phytopathology*, xxxvi, 2, pp. 112–116, 1946.

Four necrotic-spotting (N′N′) tobacco varieties [*R.A.M.*, xxii, p. 328], viz., Kelly Judy (Burley) and Kentucky 120 and 129, were inoculated in the field (except Ky. 120) with 49 dried samples of mosaic virus-infected tobacco collected over a period of 15 years, mostly in Kentucky (and including one strain from the 1882 crop), three from chilli, and two from *Physalis* sp. The symptoms induced by the different strains varied greatly both under greenhouse and field conditions, comprising all shades of mottling from pure white to dark green, different degrees of distortion, stunting, and burn, and several types and sizes of chlorotic and necrotic local spots. The symptoms on replicate plants were, however, identical. On a basis of similarity of symptoms and for convenience of tabulation, the collections were placed in a minimum of 19 greenhouse and 33 field groups.

Most of these tobacco mosaic virus collections, if studied on a non-necrotic spotting (n′n′) variety like Kentucky 16, would have been referred to tobacco virus 1 or *Nicotiana* virus 1, as defined by J. Johnson [ibid., xvi, p. 480] and K. M. Smith [ibid., xvii, p. 52]. For this reason the authors deprecate the use of the terms 'tobacco virus 1', 'common field tobacco-mosaic virus', or 'wild type tobacco-mosaic virus' as indicative of specific entities.

STRONG (M. C.). **The effects of soil moisture and temperature on Fusarium wilt of Tomato.**—*Phytopathology*, xxxvi, 3, pp. 218–225, 1 fig., 1 graph, 1946.

Ten years' field observations in Michigan on the relation of rainfall to the incidence of tomato wilt (*Fusarium*) [*bulbigenum* var. *lycopersici*] and greenhouse tests at constant soil-moisture and temperature levels indicate that the resistant

Marglobe and the susceptible John Baer variety respond in an opposite manner to the former factor [cf. *R.A.M.*, ii, pp. 428, 477; vi, p. 516; vii, p. 750]. Thus, Marglobe was more susceptible to infection at a soil-moisture level of 60 per cent. saturation than at 85 per cent., whereas in John Baer the relative positions were reversed. When soil-temperature conditions were kept constant and soil-moisture values changed during the tests, a reduction in the latter decreased the incidence of wilt in John Baer, while an increased supply of moisture raised it. Conversely, in Marglobe a rise in the soil-moisture content from 60 to 85 per cent. saturation reduced the amount of wilt, which was increased, on the other hand, by a fall in the moisture level.

Unlike soil-moisture alterations, those of the temperature levels did not elicit differing reactions from the two varieties, both of which were more susceptible to wilt at 28° C. than at 22°. With a constant soil-moisture level and a rise in soil temperature from 22° to 28°, the incidence of infection tended to increase in both varieties, whereas a fall in soil temperature from 28° to 22° did not affect the percentage of wilt developing.

GÄUMANN (E.) & JAAG (O.). **Über das Problem der Welkekrankheiten bei Pflanzen.** [On the problem of wilt diseases in plants.]—*Experientia*, ii, 6, pp. 215–220, 3 figs., 3 graphs, 1946. [English summary.]

'Lycomarasmin', a plasma toxin secreted by *Fusarium* [*bulbigenum* var.] *lycopersici*, the agent of tomato wilt [*R.A.M.*, xxv, p. 84], was experimentally shown to cause pathological wilting of tomato plants, usually accompanied by disturbance of the water balance, at dilutions of 10^{-2} and 10^{-3} M; at 10^{-4} M only the latter symptom was observed. These results are explained on the theory that the semi-permeability of the plasma membranes is completely destroyed by the higher concentrations of the toxin, whereas at a lower one only the permeability of the exterior plasma boundary layer for water is affected.

WALKER (J. C.) & FOSTER (R. E.). **Plant nutrition in relation to disease development. III. Fusarium wilt of Tomato.**—*Amer. J. Bot.*, xxxiii, 4, pp. 259–264, 3 graphs, 1946.

Studies are presented of the relation of nutrient salt concentration and nutrient ion balance to *Fusarium* wilt of tomato by methods similar to those reported by the senior author and W. J. Hooker for cabbage yellows (*Fusarium conglutinans*) and club root [*R.A.M.*, xxiv, p. 484; xxv, p. 148]. Two-week-old plants of the Bonny Best, Marglobe, Master Marglobe, and Red Currant varieties were used, the first being the most susceptible, while Red Currant developed no disease. Growth of the fungus, that of the young host plants, and wilt development have approximately the same optimum temperature and the plants were grown at this temperature. The fungus used was a virulent strain of *F. oxysporum* [*F. bulbigenum*] f. *lycopersici*.

Increases of salt concentration from 0·1 to 1 of Hoagland and Snyder's solution (*Proc. Amer. Soc. hort. Sci.*, xxx, pp. 288–294, 1933) were accompanied by a notable slowing-up in the rate of disease incidence, which slowed still more when the concentration was doubled; but when the concentration was trebled it increased again slightly. Thus, the greatest rate of disease incidence occurred at the weakest concentration when the growth of both the host and pathogen is reduced, that of the host to a greater degree. Low potassium or high nitrogen at the same osmotic pressure stimulated the activity of the disease, and high potassium or low nitrogen diminished it.

While the response to these experiments was similar to that noted in cabbage yellows, the manner in which it takes effect cannot yet be explained. Values for diffusion pressure deficit of healthy plants on the one hand, and disease

development on the other, offered an approximately negative correlation in the nutrient concentration series.

When the same strain of the pathogen was used, the disease expression of the intermediate resistant varieties followed the same curve in relation to salt concentration as the susceptible varieties, but always at lower values. When single-gene high resistance was present in the host no disease was observed at any extreme of nutrient concentration or balance. This suggests that in the field single-gene resistance should be more satisfactory than multiple-gene resistance. In the same nutrient concentrations the disease developed more rapidly in an intermediate resistant variety exposed to a virulent strain of the pathogen than in the susceptible variety exposed to a mild strain. Wilt, whether induced by the mild or the virulent strain, has the same relation to nutrition even though there is a difference in total disease development during a given period.

BERGER (G.). **Une bactériose de la Tomate nouvellement observée au Maroc (Phytomonas michiganensis [E. F. Smith] Bergey et al.)** [A bacterial disease of Tomato newly observed in Morocco (*Phytomonas michiganensis* [E. F. Smith] Bergey et al.).]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 177–187, 7 figs., 1942. [Received April, 1946.]

In May, 1937, a few tomato fruits in a market garden at Chaouia, Morocco, were found to be affected by *Phytomonas michiganensis* [*Corynebacterium michiganense*: *R.A.M.*, xxiii, p. 475; xxiv, p. 352], not previously recorded in North Africa. The disease was no longer present in the following spring. Cultures maintained at the Casablanca laboratory for a year on potato and on milk produced white spots in three days on [tomato] fruits sprinkled with them. Inoculations on to unwounded surfaces of the fruits gave as rapid and as good infections as when prick inoculations were made. Sprinkling the roots of young tomato plants with a suspension of the bacteria at transplanting invariably gave positive results; after 12 to 15 days growth became retarded, the plants yellowed, the leaves wilted, and after a month most of the plants were dead. Wound inoculations made by pinching the leaves or buds and adding bacteria gave the same results, but more slowly, as did prick inoculations in, or deposition of the bacterium on, various parts of the stem.

At 22° to 30° C. the incubation period of the disease and the degree of severity of attack were found to depend on the age of the host or of the infected organs. On young plants the first symptoms usually appeared 15 to 20 days after inoculation, wherever it was effected. On older plants the incubation period was longer, some showing no outward symptom even after two months, though the stem tissues were markedly disorganized. On young fruits the size of a nut or even larger, white spots appeared three days after deposition of the organism; on well-developed fruits or those that were beginning to colour, positive results were not obtained.

Observations indicated that the seed in infected fruits is probably diseased, but such seed showed no sign of the condition, ripened normally, and showed no reduction in germinability. Of 80 plants grown from seed from affected tomatoes sown at the end of August, 1938, only three showed the disease in November.

Attempts to transmit the disease to potato, tobacco, eggplant, and pimento gave negative results.

TROY (V. S.). **Mold counting of Tomato products.**—*Canner*, cii, 22, pp. 26–28, 30, 1 fig., 1 diag., 1946.

Directions are given for the application of the 'Howard mould count', the procedure recognized by the Association of Official Agricultural Chemists (United States), to the microbiological investigation of commercial tomato products [cf. *R.A.M.*, xxi, p. 309]. Among the most prevalent contaminants are *Alternaria*

[? *tomato*], *Colletotrichum* [*phomoides*], *Fusarium* [*bulbigenum* var. *lycopersici*], and *Mucor* sp. (especially on tomatoes held for a long time before canning). The following are some of the practices contributing to a low mould count: efficient sorting and trimming of the fruits; regulation of the speed of sorting and trimming belts to a maximum of 25 ft. per minute; shallow piling of the tomatoes on the belt, preferably in a single layer; thorough washing of the fruits by sprays of 100 to 150 lb. pressure; and strict attention to sanitation of all equipment, including passage of the sorting and trimming belts through a disinfectant bath prior to their return journey.

BEST (R. J.). **Thermal inactivation of Tomato spotted wilt virus. Part 1.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 1, pp. 21–25, 1 graph, 1946.

The thermal death point of the tomato spotted wilt virus, i.e., the maximum temperature at which active virus could be demonstrated in *in vitro* experiments after a ten-minute exposure, was 45·5° C., the rate of inactivation at 35° following a logarithmic course and behaving as a first-order reaction with a half-life period of 20 minutes. In preliminary tests on the thermal inactivation of the virus *in vivo*, 97 per cent. of the active principle in inoculated Dwarf Champion glasshouse tomatoes was inactivated by 24 hours' exposure to an air temperature of 40°. The results of another series of trials on naturally infected Early Dwarf Red and Ponderosa field plants were comparable, but presented certain anomalies in the case of the former variety due to the presence of another, unidentified virus together with that of spotted wilt. The bearing of these results on the behaviour of experimental material during alterations of hot and cool weather is discussed.

BEST (R. J.). **Inactivation of Tomato spotted wilt virus by salicylate.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 1, pp. 26–31, 2 graphs, 1946.

The tomato spotted wilt virus was inactivated by potassium salicylate solutions [*R.A.M.*, xix, p. 496] at a concentration of 0·02 M and upwards, the pH being maintained at 7 and the temperature at 30° C. At and above a salicylate concentration of 0·25 M inactivation was instantaneous, while between 0·02 and 0·07 M the process followed a logarithmic course at a measurable velocity.

WATERMAN (ALMA M.). **Canker of hybrid Poplar clones in the United States caused by Septoria musiva.**—*Phytopathology*, xxxvi, 2, pp. 148–156, 1 fig., 1946.

A canker disease of hybrid poplar clones in two plantings in New York State and one in Tennessee is caused by *Septoria musiva*, hitherto reported only on exotic and hybrid poplars in Canada and Argentina [*R.A.M.*, xxiii, p. 365]. Infection occurs through uninjured leaves and petioles or twig wounds and soon after pycnidia and spores appear. Cankers are formed on twigs of the current season's growth and subsequently on the stems, the latter being girdled in susceptible species; in more resistant ones the cankers may become infected by secondary fungi, such as *Cytospora* (?) *chrysosperma*, which outstrip *S. musiva* in their rate of development and tend to mask its presence.

The author tested by greenhouse and outdoor inoculations with *S. musiva* the reactions of ten hybrid clones with proved adaptability to reforestation. Infection occurred in uninjured leaves and petioles as well as in stem wounds. The fungus was reisolated from the cankers formed. A high degree of susceptibility was indicated for one clone with a parentage of *Populus nigra* × *P. laurifolia*, two of *P. maximowiczii* × *P. berolinensis*, and one of *P. maximowiczii* × *P. nigra* var. *plantierensis*, whereas all the inoculations on *P. candicans* × *P. berolinensis* gave negative results.

Cristinzio (M.). **Le malattie crittogamiche del Noce (Juglans regia L.).** [The fungal diseases of Walnut (*Juglans regia* L.).]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 17–64, 3 pl., 9 figs., 1942. [Received April, 1946.]

Full notes are given on the following walnut (*Juglans regia*) diseases in Italy, with special reference to the conditions obtaining in the Campagna: 'mal secco' (*Phytomonas* [*Xanthomonas*] *juglandis*) [*R.A.M.*, xi, p. 766; xxiv, p. 170], 'mal nero' (*Phytophthora cambivora*) [ibid., xiii, p. 336; xix, p. 68], anthracnose (*Gnomonia juglandis*) [*G. leptostyla*] (stat. conid. *Marssonia* [*Marssonina*] *juglandis*) [ibid., iii, p. 197; xxii, p. 117; xxiv, p. 387], downy spot (*Microstroma juglandis*) [ibid., xix, p. 309], trunk and branch rot (*Polyporus sulphureus*, *P. hispidus*, *P. squamosus*, and *Fomes igniarius*) [cf. ibid., xv, p. 330; xvi, pp. 358, 715], white disease or root rot (*Rosellinia necatrix* and *Armillaria mellea*) [cf. ibid., xxi, p. 311], crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), powdery mildew (*Microsphaera alni*), leaf-withering due to *Ascochyta juglandis* [ibid., xix, p. 309], and fruit scab (*Gloeosporium epicarpii*) [ibid., xiv, p. 204].

'Mal secco' disease occurs in all parts of Italy, particularly in the south. Spread is favoured by injuries to the trees caused by insects (especially *Cossus cossus*), weather, and human agency, e.g., striking the branches with poles when gathering the nuts. This practice should cease. Insecticidal treatments should be applied, and wounds disinfected with a 15 per cent. solution of iron sulphate and painted with tar or red lead. Crown-grafting should be practised instead of cleft-grafting. Careful pruning immediately after harvesting is also advised. Spraying with ordinary Bordeaux mixture should be carried out immediately the fruit has set.

The most serious and important walnut disease in Italy is 'mal nero' or ink disease. It is very prevalent, and causes heavy losses in the Campagna, particularly in the provinces of Salerno and Naples. If any walnut tree develops a slight or partial leaf yellowing, the main roots should be uncovered [cf. ibid., viii, p. 474]. If black spots are found, confined to the collar and roots, all the diseased tissues should be cut away and the wounds disinfected as usual. The roots should be left uncovered, and they and the base of the stem may be painted with a 10 to 15 per cent. solution of iron sulphate, or with 5 per cent. copper sulphate, or with milk of lime. The roots of destroyed trees should be removed from the soil and the area not replanted for some years. *Gnomonia leptostyla* is most prevalent in the Po valley, Tuscany, the Campagna, and Calabria. Applications of Bordeaux mixture (1 to 1·5 per cent.) should be made at fruit-set, early in August, and immediately after harvest, when infected parts should be removed. *Microstroma juglandis* is most frequent in the south and in Sicily, where it sometimes causes heavy losses. Bordeaux treatment is very effective; in localities where the disease is very prevalent, one or two pre-infection applications should be made in spring. If to spray very large trees is too expensive, the smaller ones and the young nuts, in particular, should always be treated. *Polyporus sulphureus* occurs frequently and was often observed in the provinces of Naples, Salerno, and Avellini, particularly on walnuts attacked by root rot and 'mal secco'. *P. hispidus* is also common. *P. squamosus* is as frequent but causes less damage. *F. igniarius* causes a common white rot. To control these fungi, tree surgery is recommended.

Rosellinia necatrix and *Armillaria mellea* are often associated with *Phytophthora cambivora*, the symptoms of which they mask, and the injurious effects of which they aggravate. During the early stages, good results are obtained by placing pieces of iron sulphate weighing 100 or 150 gm. at the base of the affected trees.

In the Campagna, *Bact. tumefaciens* attacks walnuts mostly when very young. Treatment is advised by surgical methods. Stable manure and organic fertilizers should not be applied heavily; the use of mineral superphosphate with iron sulphate is advantageous.

Powdery mildew occurs to some extent everywhere in the Campagna, being most frequent in thickly planted walnut groves near other fruit trees; it does not, however, cause much damage. Sulphur-dusting is indicated in general, but in old, severe infections two liquid treatments with 0·5 per cent. lime-sulphur or calcium sulphide at an interval of a fortnight should be applied when seasonal conditions favour the disease.

Ascochyta juglandis was first observed in 1932, near Nola, and since then has appeared in other parts of the Campagna. It is the least harmful of walnut diseases and causes a certain amount of damage only in wet seasons, when spraying with Bordeaux mixture should be carried out. *Gloeosporium epicarpii* is less common than *A. juglandis*, but more harmful. Spraying with Bordeaux mixture (1 per cent.) before flowering and after fruit-set is recommended.

In all cases infected material on the trees or on the ground and severely diseased trees should be burnt.

Conifer heart-rot (Fomes annosus (Fr.) Cooke Trametes radiciperda Hartig). Honey fungus Armillaria mellea Vahl. Agaricus melleus L. Two leaf-cast diseases of Douglas Fir.—*Leafl. For. Comm., Lond.*, 5, 7 pp., 3 figs.; 6, 7 pp., 4 figs.; 18, 6 pp., 3 figs., 1946.

These are entirely revised versions (January, 1946) of the popular accounts of conifer heart-rot (*Fomes annosus*); the honey fungus (*Armillaria mellea*), commonly found on young conifers but capable of attacking broad-leaved trees under certain environmental conditions; and two leaf-cast diseases of Douglas fir (*Pseudotsuga douglasii* and its var. *caesia* and *P. glauca*) [*P. taxifolia*] caused by *Phaeocryptopus gaeumanni* and *Rhabdocline pseudotsugae*, respectively [*R.A.M.*, vii, p. 482]. Leaflets 5 and 6 were originally published in 1921 and 18 in 1927.

Report of Committee on Preservatives.—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 20–25, 1945.

This report and those of certain other committees (pp. 25–119) of the American Wood Preservers' Association deal, *inter alia*, with suggested changes in the specifications for the preservative treatments of timber in the United States [cf. *R.A.M.*, xxiv, pp. 347, 348].

Seyer (W. F.). **The leaching of copper, zinc and arsenic salts from wood piles.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 137–144, 1 fig., 3 graphs, 1945.

An experiment is described which showed that the rate of leaching of toxic solutions from a 40-ft. Douglas fir [*Pseudotsuga taxifolia*] pile treated with a solution of copper sulphate, zinc sulphate, and arsenic trioxide and a so-called fixing agent was such that after one year 45 per cent. of the salts had been removed. How much toxic salt should be introduced into the pile to afford protection over a specified period of years is indicated by a graph.

Schmitz (H.), von Schrenk (H.), & Kammerer (A. L.). **Studies of the biological environment in treated wood in relation to service life. III. Changes in the character and amount of 60/40 creosote-coal tar solution and coal tar and the decay resistance of the wood of Red Oak crossties after five years' service.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 153–179, 4 figs., 1 graph, 1945.

This paper completes the second of a planned series of studies on the biological environment in treated wood in relation to the service life of red oak [*Quercus* spp.] sleepers [*R.A.M.*, xxi, p. 108; xxiv, p. 348]. The present study deals with two red oak sleepers treated with 60 : 40 creosote-coal tar solution and two with coal tar, after five years on the track. It was again found that after five years' service, the greatest changes in the chemical and physical characteristics of both preservatives

occurred in the outer zones, with progressively smaller changes from the outside zone to the inner ones. Some of the differences in specific gravity and in the loss of low-boiling fractions found after three years between the bottom outer zone and the top outer zone appeared to have partly disappeared after five years, though the tar acid content of the preservative extracted from the bottom outer zone was lower, save in one instance, than that of the preservative extracted from the top zone. On the whole, it would seem that the rate of change of the preservative in the outer and inner zones declined during the last two years, particularly in the lower half of the sleepers.

The toxicities of the preservatives extracted from the outer zone of the bottom half of the sleepers after five, as after three, years' service were mostly lower than the toxicities of the preservatives extracted from the outer zone of the top half.

After five years, no significant difference was noted between the toxicity of 60 : 40 creosote-coal tar solution and coal tar, as regards the concentration necessary to inhibit or kill Madison 517 (*Fomes annosus*) or *Trametes serialis*. Thus, all differences in the initial toxicity of the preservatives had disappeared after five years' service. The evidence available strongly supports the view that the sleepers treated with 60 : 40 creosote-coal tar and with coal tar will give many more years' service. The importance generally attributed to differences in the initial toxicity of coal tar products requires modification.

In a written critical discussion of this paper (pp. 179–188), L. B. Shipley points out, *inter alia*, that the coal tar used in these studies was evidently of a special light grade; and hence, the results obtained do not apply to the usual coal tars.

Dosker (C. D.). **Laminating lumber suitable for wood preserving.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 212–228, 12 figs., 1945.

A description is given of a new process for the lamination of timber products, by means of which the laminated timbers are rendered as resistant to decay, insects, and fire as solid timbers of the same kind of wood. Experimental and other work indicates that laminated products fabricated by the process described can be treated safely with preservatives.

Cristinzio (M.). **La Plasmodiophora brassicae Wor. nella Campania e la sua diffusione in Italia.** [*Plasmodiophora brassicae* Wor. in the Campagna and its prevalence in Italy.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 65–82, 2 pl., 2 figs., 1942. [Received April, 1946.]

In November, 1941, two extensive cauliflower plantations in the vicinity of Pompeii, situated on a flat, almost treeless plain near the river Sarno, were severely affected by club root (*Plasmodiophora brassicae*). Later inspections showed that the fungus was present in numerous other cauliflower plantings in the locality, other cultivated crucifers (but not the wild ones) also being affected, though much less severely. It appeared that the disease had been present for at least two or three years.

P. brassicae was first reported in Italy near Genoa in 1889 and the steady southward spread would appear to indicate that it is adapting itself to warmer climatic conditions. Apart from one report in 1901 from Avellino, the present outbreak of *P. brassicae* appears to be the first in the Campagna, the most southerly boundary of its extension. Its rapid spread in the area concerned is attributable to the local soil and climatic conditions, and cultural practices. The soil, especially near the river Sarno, is cold and damp, with stagnant water present in places during winter. Mists also occur at times. Infection, moreover, was favoured by heavy dressings of stable manure, and by neglect on the part of the growers to destroy the infected plants.

The control measures recommended consist in the removal of infected plants and, immediately after harvesting, of all plant remains, ceasing to grow cauliflowers for

two years or more (or, if continued, liming the soil at the rate of 400 to 500 kg. per ha.), making light applications of organic fertilizers with chemical supplements, transplanting only healthy plants, soil drainage, and seed disinfection by means of one hour's immersion in 0·25 per cent. uspulun.

Walker (J. C.), Jolivette (J. P.), & Hare (W. W.). **Varietal susceptibility in garden Beets to boron deficiency.**—*Soil Sci.*, lix, 6, pp. 461–464, 1945.

Trials were conducted in two localities in Wisconsin to determine the reactions of some garden beet varieties in common use to boron deficiency [*R.A.M.*, xxii, p. 335]. In 1940 and 1941 the most susceptible lots were Flat Egyptian, Light Red Crosby, Good for All, Morse Detroit, and one strain each of Early Wonder, Short Top Detroit, and Conners' Detroit. The indexes (two-year average) for these varieties (where 0 represents no disease and 100 all roots severely attacked) were 67, 58, 59, 54, 56, 62, and 54, respectively. One strain of Early Blood Turnip was resistant, and Long Dark Blood was virtually free from disease, with averages of 7 and 0·5, respectively. The remaining 21 stocks were intermediate in their responses. In 1944 further tests were carried out on nine varieties, of which Long Dark Blood was immune (average of four replicates 0), while the only others showing any appreciable degree of resistance were Crosby Egyptian and Early Blood Turnip (19 and 15, respectively).

Much significance is attached to these varietal differences in susceptibility to boron deficiency, which will probably need correction in all the stocks tested except Long Dark Blood. Beet improvement without reference to boron deficiency may be a cause of disappointment; the Good for All variety of fancy 'rosebud' grade, for instance, had to be rapidly discarded on account of its extreme susceptibility to internal black spot in boron-deficient soils.

Cook (R. L.) & Millar (C. E.). **The effect of borax on the yield, appearance, and mineral composition of Spinach and Sugar Beets.**—*Proc. Soil Sci. Amer.*, v, pp. 227–234, 3 figs., 1940. [Received July, 1946.]

At the Michigan Agricultural Experiment Station, a side-dressing of borax at the rate of 20 lb. per acre reduced the incidence of heart in rot in sugar beets [see preceding abstract] on Wisner silt loam soil from 96·9 to 11·4 per cent. and increased the yield from 7·2 to 14·3 tons per acre, with a corresponding increment in the individual root weight from 0·9 to 1·8 lb. The treatment likewise increased the sucrose and purity percentages from 14·1 to 18 and 80·9 to 84·9, respectively. Only insignificant further increases were obtained by a 40 lb. per acre application.

At a dosage of 10 lb. per acre, borax prevented the development of boron deficiency symptoms in spinach [*R.A.M.*, xvii, p. 717], which are almost identical with those in beet, and raised the yield from 8·1 to 14·3 lb. per plat. No advantage was derived from the application of larger quantities (up to 80 lb. per acre) of the fertilizer.

The modifications in the mineral composition of the plants induced by the soil amendments are described.

[A slightly different version of this paper appeared in *Bett. Crops*, 12 pp., 6 figs., 1941.]

Cook (R. L.). **Manganese sulphate and borax for Sugar Beets.**—*Sug. Beet J., 1946*, pp. 197–198, 1946. [Abs. in *Sugar*, xli, 5, p. 51, 1946.]

On alkaline or neutral soils in Michigan manganese is combined in a form too slowly available for sugar beets, the deficiency causing foliar mottling and reduction in yield [cf. *R.A.M.*, xxi, p. 468]. The characteristic leaf patterns appear in the early summer, in time for a remedial side-dressing of manganese sulphate. In 1943 the compound was applied as a side-dressing and spray on a farm in Tuscola county

at dosages of 100 and 5 lb. per acre, respectively. Marked differences in leaf colour were noticeable within ten days of the treatments, and the yields from the side-dressed, sprayed, and untreated plots were 17·8, 16·7, and 10·8 tons per acre. A less successful experiment with manganese sulphate in Bay county suggested the operation of some other limiting factor, possibly cold, wet weather, which tends to induce manganese starvation by retarding the oxidation processes in the soil. Sufficient borax should be included in the fertilizer to bring the rate of application to 8 to 10 lb. per acre [see preceding abstract].

Anderson (M. E.). **Two new wilt-resistant Pea varieties for processors.**—*Canner*, cii, 6, p. 22, 2 figs., 1946.

Descriptive notes are given on two new pea varieties resistant to wilt (*Fusarium* [*orthoceras* var. *pisi*]) in the United States, namely, Rogers Early Perfection, a cross between Premium Gem and Rogers Climax, and Rogers Wilt Resistant Thomas Laxton No. 251 [cf. *R.A.M.*, xxiv, p. 486].

Pryor (D. E.) & Wester (R. E.). **Relative resistance and susceptibility of U.S. 243 and U.S. 343 Lima Beans to Lima Bean mosaic.**—*Phytopathology*, xxxvi, 2, pp. 170–172, 1 fig., 1946.

Two promising varieties of Lima bean [*Phaseolus lunatus*], U.S. 243 and U.S. 343, were being increased for distribution in 1945. In one garden trial planting in June, 33 out of 49 plants in a 20-ft. row of U.S. 343 were found to be affected by a virus which was shown by inoculation tests to be similar to that described by Harter [*R.A.M.*, xvii, p. 788]. On the other hand, all 33 plants of U.S. 243 appeared healthy, and were shown by inoculations to tobacco to be resistant and not merely symptomless carriers.

The disease is of little economic importance, and the interest of these observations lies in the fact that both lines are derived from the same Fordhook × Sieva cross, in which the former parent is resistant and the latter susceptible. The fortuitous isolation of one resistant and one susceptible line emphasizes the need for strict attention to the pathological aspects of the breeding programme.

Price (W. C.) & Black (L. M.). **The antigenicity of southern Bean mosaic virus.**—*Phytopathology*, xxxvi, 2, pp. 157–161, 1946.

The southern bean mosaic virus [*R.A.M.*, xxv, p. 326] was shown to be antigenic, and its precipitin reaction can serve as a useful means for its differentiation from other viruses. It is serologically distinct from the viruses of tobacco necrosis and tomato bushy stunt, which it resembles in certain physical properties, and also from potato ring spot [potato virus X] and veinbanding [potato virus Y], and the tobacco mosaic and etch viruses. The anti-serum, prepared with purified southern bean mosaic virus, reacts specifically with the juice of infected Bountiful beans (*Phaseolus vulgaris*). These data supplement the cumulative evidence already presented as to the independence and specificity of the southern bean mosaic virus.

Porter (R. H.). **Induced baldhead in Soybean.**—*Phytopathology*, xxxvi, 2, pp. 168–170, 1 fig., 1946.

Data obtained at the Iowa Agricultural Experiment Station in 1944 and 1945 indicate that soy-bean seed of high germinability, when planted in soil with a 15 per cent. moisture content naturally infested by *Pythium graminicola* and *P. debaryanum* and kept at 10° C. for 7 to 10 days before transferring to 26° to 28°, is likely to produce a large proportion of 'baldhead' seedlings, in which the plumule is partially or wholly decayed. In a test in 1944, of 400 untreated Bansei seeds planted under these conditions, 18·2 per cent. gave rise to 'baldheads', the corresponding figures for the lots treated with arason, spergon, and fermate being 1·4,

0·65, and 4·4, respectively. In a similar trial in 1945, the percentages of infection in the control lot and those treated with semesan jr., spergon, and arasan were 8·2, 7·2, 1·2, and 0·2, respectively, for the Kanro variety and 39·2, 19·5, 2·2, and 0·5, respectively, for Lincoln. In a test on the two last-named varieties to determine the effect of low temperature alone, 1 per cent. 'baldhead' developed both in the untreated and arasan-treated lots maintained at 10° for ten days.

Wilson (J. D.). **Relative susceptibility of Carrot varieties to nematode damage, yellows, and defoliation by blights.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxxi, 239, pp. 35–39, 2 figs., 1946.

The aster yellows virus did not assume a virulent form on any of the 35 carrot varieties [*R.A.M.*, xxv, p. 248] tested in 1945 in Ohio for their reactions to this disease and the leaf blights caused by *Macrosporium* [*Alternaria carotae*] and *Cercospora carotae* [ibid., xxiv, p. 303], but its incidence exceeded 10 per cent. on Streamliner, Amsterdam Forcing, Short Top Shipper, St. Vallery, and Improved Short White. On the other hand, Coreless, Chantenay, French Market, Nantes Half Long, Luc, Goldenhart, and French Forcing showed less than 4 per cent. infection.

There was a wide variation in susceptibility to defoliation by *A. carotae* and *C. carotae*, perhaps due in part to the delayed development of severe infection until late in the season, by which time the tops of many of the early-maturing varieties had begun to die off from natural causes. Among the most susceptible were French Forcing, Nantes Half Long, Touchon, and Table Queen, while Chantenay, Red Heart, Hutchinson, French Market, and White and Yellow Belgians sustained little damage.

Nusbaum (C. J.). **Internal brown spot, a boron deficiency disease of Sweet Potato.**—*Phytopathology*, xxxvi, 2, pp. 164–167, 2 figs., 1946.

In the course of experiments on the control of internal cork of sweet potato in South Carolina by soil amendments with borax [*R.A.M.*, xxv, p. 97], some plants in the untreated plots showed restriction of the terminal growth, shortening of the internodes, yellowing and shedding of the older leaves, and partial collapse near the crown. The roots were lopsided, dumb-bell- or spindle-shaped, and usually bore superficial cankers, sometimes covered with a hardened, blackened exudate, while scattered through the flesh, predominantly in the cambial zone near the periphery, were brown, indistinctly marginate, necrotic areas. The flesh of diseased roots was generally inferior in colour and consistency to that of sound ones.

Willis (*Spec. Circ. N.C. agric. Exp. Sta.* 1, 1943) has shown that small applications of borax often prevent the cracking of sweet potato roots and improve the flavour and texture of the flesh, and suggests that a similar treatment may reduce or eliminate the dark discoloration previously attributed to chilling at temperatures above freezing. In the writer's experiments, however, a small proportion of cracked roots occurred in nearly all the plots, irrespective of the amount of borax applied. Moreover, the internal brown spot herein described was observed in sweet potatoes which had not been exposed to temperatures below 50° F., either in the field or in storage, and was quite different from the discoloration and subsequent collapse of the flesh commonly ascribed to chilling injury.

Branas (J.) & Bernon (G.). **Essais de soufres et de produits soufrés à l'École Nationale d'Agriculture de Montpellier.** [Trials with sulphur and sulphur products at the National School of Agriculture, Montpellier.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 83–129, 10 figs., 8 graphs, 1943. [Received April, 1946.]

A full account is given of studies carried out at Montpellier in 1941 and 1942 on the use of sulphur and sulphur products against vine *Oidium* (*Uncinula*

necator). A laboratory method was used for estimating the activity of different forms of sulphur from the weight of sulphur vaporized by heat. The experiments showed that the volatility and hence the efficacy of sulphur dusts depend on the colour, the temperature, area covered, adhesiveness, and apparent density. Vaporization begins at a temperature probably over 18° C. but is not very great below 55°. If a filler is used it should be preferably of a dark colour. Field tests to determine the relative effectiveness of different sulphur treatments showed that when equal quantities of very finely powdered sulphur and flowers of sulphur are used under identical conditions, the action of the former on *U. necator* is not greater, and may be less, than that of flowers of sulphur. Experimental confirmation was obtained of the view that triturated sulphur is less effective than sublimed sulphur.

It was also found that as the size of the particles in a given weight of sulphur decreases, so the vaporization, at a fixed temperature and under identical conditions, increases to a maximum and then declines. It is not possible, however, to increase the effectiveness of triturated sulphurs by seeking a very high degree of fineness. Pure ventilated sulphurs are not a good form of sulphur to use for dusting purposes, but they are suitable for the manufacture of dusts containing small quantities of filler and of wettable sulphurs to be used in aqueous suspensions.

Comparisons of standard triturated sulphur with triturated sulphur (80, 50, and 25 per cent. free sulphur) containing crushed carbonate of lime as filler (added by dispersion) showed that, judged by the figures obtained for density, adherence, and vapour emission, the use of an inert filler reduces the amount of vapour emitted more or less proportionately to the amount of non-sulphur present. Hence, fillers added by dispersion adversely affect the probable effectiveness of pure sulphurs. Vineyard tests indicated that the effectiveness of a sulphur so filled declines rapidly with even a small addition of inert filler. The addition of a filler (bentonite) by impregnation was demonstrated in vineyard tests to be more favourable to the action of the sulphur than addition of a filler by dispersion.

Natural sulphurs enriched by the addition of 48 per cent. free sulphur are less effective than sublimed sulphur and less active also than triturated sulphur. Enrichment provides a convenient method of making use of impure sulphurs, but in ordinary circumstances the resulting effectiveness is less than that of pure sulphurs. Enriched sulphurs can be used in water like wettable sulphurs.

For an equal content of free sulphur, black sulphurs [*R.A.M.*, xv, p. 478] are distinctly superior to filled sulphurs, whatever filling method is used, though they are inconvenient to handle. Wettable sulphurs do not, by themselves, afford adequate protection, but they can usefully be applied in spring when weather conditions are against dust treatments, recourse to which should be had for the final applications. Colloidal sulphurs, under the conditions in which the experiments were made, were entirely unsatisfactory.

It is concluded that under all ordinary conditions, the pure forms of sulphur (sublimed and triturated) should be used in preference to any other sulphur product, the triturated form and other less active forms being reserved for rather resistant vines and for hot climates where the rate of vaporization is higher. Other forms of sulphur are of no interest unless economical and sufficiently effective. When it is not possible to obtain enough sulphur, the control of *U. necator* is likely to be incomplete. In such cases, wettable sulphur, which uses less sulphur than dusts, must be used for the first treatment or the first two, and impure sulphurs for the others. The lack of pure sulphur constitutes a danger to vineyards which grows greater every year, since each year the disease appears in a worse form than the year before, owing to previous inadequate treatment.

Moreau (L.), Vinet (E.), & Simon. **L'Oidium en 1942 au vignoble expérimental de Belle-Beille.** [*Oidium* in 1942 in the experimental vineyard of Belle-Beille.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 131–133, 1943. [Received April, 1946.]

Spraying and dusting trials carried out in 1942 against *Oidium* [*Uncinula necator*: see preceding abstract] in an experimental vineyard of Chenin vines at Belle-Beille, France, are described.

It is concluded that the inclusion of potassium permanganate (100 gm. per hectol.) in the cupro-arsenical mixture used for the first two treatments advised for susceptible vines should become a general practice in the Loire region. It allowed one sulphur dusting to be omitted and would have given even better results if a sticker had been used. Bordeaux mixture 1 per cent. with a sulphonated terpenic alcohol sticker exerts an appreciable effect on *U. necator*. Removal of leaves on a level with the bunches and on the east side only, during July, is essential in vineyards where growth is luxuriant. The use of bituminous sulphur containing 12 to 16 per cent. sulphur following spraying with potassium permanganate (125 gm. per hectol.) gave very satisfactory results on vines already badly infected. These conclusions apply only to the valley of the Loire and the vine varieties there grown.

Schad (C.). **Étude des facteurs de l'infection primaire et de la durée de l'incubation en vue de la prévision des époques de traitements contre le mildiou de la Vigne.** [A study of the factors of primary infection and of duration of incubation with a view to forecasting periods of treatment against Vine mildew.]—*Ann. Épiphyt.*, N.S., ix, 1, pp. 19–25, 1943. [Received April, 1946.]

After referring to the methods followed in France in forecasting outbreaks of vine mildew [*Plasmopara viticola*: *R.A.M.*, xvi, p. 513 and next abstracts], the author summarizes the data obtained in 1938, 1939, and 1940. In March, April, and May, specimen lots of infected leaves from local observation posts are examined in the station laboratory, and the progress of oospore germination under the local conditions is thus followed. The factors determining primary infection in the field are: the presence of active oospores (detected by laboratory observation), a temperature above 11° C., and a rainy period that keeps the surface of the soil wet for several days. From these it is possible to foretell exactly the period of primary infection. By following the temperature and rainfall and knowing the germinative capacity of the spores and their frequency, it is possible to predict also the extent of the first infection.

Secondary infections, due to the conidia, require the presence of active spores, rain, and a temperature over 8°. The prevailing temperature is always high enough in June and July. The persistence of water on the leaves for six or more hours at temperatures between 11° and 20° will inevitably induce infection. Intensity of attack depends on the extent of the primary infections, the coincidence of conidial formation with rain, the rainfall in June and July, and on the critical stages of vine growth (pre-flowering, end of flowering, and unprotected leaf area), and will determine the number of treatments required.

In calculating the incubation period [cf. ibid., xiii, p. 678], if only those hours in which the relative humidity is over 60 are considered, it is possible to time the appearance of the infection spots with greater accuracy. The proper use of all these data will enable the number of treatments to be reduced safely to a minimum.

Barraud (Mlle M.), Gaudineau (Mlle M.), & de Seze (M. R.). **Essais de traitement du mildiou de la Vigne en 1942 à La Grande-Ferrade (Gironde).** [Spray trials against Vine mildew in 1942 at La Grande-Ferrade (Gironde).]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 135–161, 3 figs., 2 graphs, 1943. [Received April, 1946.]

In the attempt to find a means of economizing copper in the control of vine mildew [*Plasmopara viticola*: see next abstracts] experiments were carried out

during 1942 on ungrafted Cabernet vines in the Gironde in which (*a*) Bordeaux mixture containing different proportions of copper was tested against new or relatively unknown products containing little or no copper, and (*b*) a selection of the above was submitted to further test. Applications in both series were made on the four dates advised by the local spray-warning service.

A relatively severe outbreak of mildew in a year particularly favourable for it enabled an effective comparison to be drawn between the products. The results obtained (as estimated by the fraction of the fruit-bunches saved by 31st July, weight of crop per 100 vines, and amount of defoliation) showed that, under the experimental conditions, the effectiveness of 2 per cent. Bordeaux mixture was unequalled; 1 per cent. was less effective, but afforded sufficient protection; 0·2 per cent. was definitely inadequate, 0·5 per cent. marking, apparently, the limit of efficacy. When 0·2 per cent. sodium alcoylxanthate was added to 1 per cent. Bordeaux mixture, effectiveness became approximately equal to that of the 2 per cent. Product 18 (an active organic compound containing 2·6 per cent. copper), used at a concentration of 1 per cent., was among the best materials, judged by weight of crop in the first series and intermediate between Bordeaux mixture 1 and 2 per cent. in the second; this material deserves attention because of the reduction in copper it allows. Product 19, an organo-metallic (non-copper) compound used at 1 per cent., was distinctly active against the fungus and merits further test. Product 20, containing copper and arsenate, is also worth further trial, as is colloidal copper.

Raucourt (M.). **Vue d'ensemble sur les essais anticryptogamiques de 1942.** [A general view of the fungicidal trials of 1942.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 163–167, 1943. [Received April, 1946.]

Reviewing the results obtained in different phytopathological stations from spraying tests against vine mildew [*Plasmopara viticola*], the author concludes that it appears to be definitely established that copper salts in the state of mineral compounds exert a fungicidal action related to the number of copper ions liberated. There is very little likelihood of discovering any exceptionally active copper salts. The search for a means of economizing copper [see preceding and next abstracts], in normal circumstances, is hardly worth while, since reduction in the amount of copper used is bound to entail a reduction in yield, unless attack by *P. viticola* happens not to be severe.

The evidence obtained in 1942 having demonstrated that certain organic compounds are of use against vine mildew [see preceding abstract], laboratory work should be intensified in this direction.

Ciferri (R.). **Nuove idee in fatto di antiperonosporici.** [New ideas on anti-Vine mildew materials.]—*Ric. sci. Progr. tec. Econ. naz.*, xiv, 2–3, p. 134, 1943. [Received February, 1946.]

Further investigations carried out in 1942 by various workers in Italy on the control of vine mildew [*Plasmopara viticola*] by materials containing little or no copper [see preceding abstracts] gave the following results. Zinc salts are less fungicidal than copper salts, for the same weight of metal. The sulphur anion is that generally used. It appears certain that there is a reciprocal activating effect between very small dosages of copper salts associated with zinc salts, and possibly one of small amounts of zinc salts associated with copper salts. An increase in the anti-mildew activity of the oxyacids seems to be excited both on the copper salts and the zinc salts. No aluminium preparations have shown any appreciable fungicidal power. The value of mercury derivatives seems very doubtful. Given equal weights of copper, the form in which it is combined affects its fungicidal ability, especially with very low concentrations. A relative, indirect fungicidal effect

appears to result from absorption by vine leaves of micronutritive elements such as boron, iron, magnesium, manganese, copper, and zinc. The cuprobentonite substances offer a promising means of applying copper fungicides at low concentrations. Some of the oxyquinoline compounds can be effectively associated with the salts of heavy metals possessing fungicidal power. The importance of dust treatments in protecting the fruit bunches was confirmed. Fungicides containing 8 per cent. or less of copper require more exact timing for their application than those containing 16 or 24 per cent., and the importance of timing is strongly emphasized.

Rivera (V.). **Sui marciumi radicali da Rosellinia necatrix e da Agaricus melleus : sensibilità per la temperatura dell' ambiente radicale, influenza del terreno e della natura del legname della pianta ospite ; mezzi di lotta.** [On root rots caused by *Rosellinia necatrix* and *Agaricus melleus*: susceptibility due to the temperature of the root environment, influence of the soil and of the nature of the wood of the plant host; methods of control.]—*Nuovo G. bot. ital.*, N.S., xlvii, 2, pp. 477–487, 5 figs., 1940. [Received April, 1946.]

Continuing his studies on the effects of temperature on fungus-infected plants [*R.A.M.*, xiii, p. 197], the author found that infection of very young layer roots of specified varieties of vine by *Rosellinia necatrix* was complete 24 hours after experimental inoculation, at 25° [C.] in humid conditions. Infection by *Agaricus melleus* [*Armillaria mellea*] was much slower. In both cases, the degree of infection reached in 24 hours at 25° did not occur in eight days at 8° (in a refrigerator). At the latter temperature *R. necatrix* gave rise to no infection at all.

Cultures of both fungi on sterile, wet straw were kept for 17 days at 8°, 16°, 22°, 25°, and 43°. At 22° and 25° *R. necatrix* filled the bottles in seven days, while *A. mellea* took 45 days. At 8°, neither fungus grew, though both remained viable; at 43° both organisms were killed. Both fungi sown on wet straw in 48 bottles were at once exposed to a temperature of 43° under wet conditions for 0, 3, 6, 12, 24, and 48 hours. Exposure to this temperature for 6 to 48 hours killed the mycelium in every case, but exposure for three hours stimulated growth.

In tests on living plants, mycelium of *R. necatrix* was placed on vine layers grown in sterile water, and the plants kept in an illuminated thermostat. They grew well at 43° and even at 45° for three or four days; inoculation on the roots gave positive results at 25°, but never gave rise to the disease at 43°. Devitalization of the fungus, which had already begun its attack on the tissues, was definitive at 43°, both as regards the external and the intracellular mycelium. Inoculations at 25° killed the plants in six or seven days.

To investigate the possibility of killing the mycelium after it was strongly established in living roots, vine layers of four varieties were grown in bottles of water and soon after inoculation placed in a thermostat at 42° for six or 12 hours, controls being kept at 25° for the same periods. The controls after four days showed severe infection; later on they died. The plants exposed to 42° for 12 hours showed no infection, and grew vigorously. Comparable results were obtained with *A. mellea*.

From these and other experiments it is concluded that exposure to a temperature of 43° for six hours in wet conditions is sufficient to kill the mycelium of *R. necatrix* and *A. mellea* when growing on dead matter, while on living susceptible plants the periods necessary to kill the mycelium appear to be 10 hours at 42°, seven at 45°, and two at 53°, the plants themselves being uninjured by exposure to these temperatures. If, however, duration of exposure is too short, or the temperature too low, the result may be to stimulate mycelial growth.

When vine twigs in different types of soil were inoculated with the same two fungi, none of the soils inhibited or retarded the saprophytic development of the mycelium.

When the fungi were placed on pieces of ten different kinds of wood, in water, and kept at laboratory temperature or 23°, no growth occurred on chestnut [*Castanea*], almost none on Italian oak, and very little on Slavonic oak, while on the others growth was more or less rapid. Further work is in progress.

Price (W. C.), Williams (R. C.), & Wyckoff (R. W. G.). **Electron micrographs of crystalline plant viruses.**—*Arch. Biochem., N.Y.*, ix, 2, pp. 175–185, 8 figs., 1946.

This is a more detailed account [cf. *R.A.M.*, xxv, pp. 59, 290, 326] of the illustration by electron-micrographical technique of molecular array in the southern bean mosaic and tomato bushy stunt viruses.

Price (W. C.) & Wyckoff (R. W. G.). **Electron micrographs of molecules on the face of a crystal.** *Nature, Lond.*, clvii, 3997, p. 764, 2 figs., 1946.

This is a description of the method of preparing shadowed replicas of the faces of single crystals of viruses for the purpose of making electron micrographs of the molecular disposition [see preceding abstract]. Two remarkable photographs prepared by this method show a shadowed replica of a single crystal of the southern bean mosaic virus, one magnified 8,200 times in which the regular array of molecular particles can be seen, and the other of parts of two adjacent crystal faces at a magnification of 26,000.

Frampton (V. L.) & Takahashi (W. N.). **Electrophoretic studies with the plant viruses.**—*Phytopathology*, xxxvi, 2, pp. 129–141, 5 figs., 2 diags., 1946.

A description is given of the moving-boundary method of electrophoresis, by means of which specific 'scanning patterns' were obtained for the extracts of healthy Turkish tobacco and of plants of the same variety infected with the tobacco mosaic virus, potato X and potato Y viruses, the cucumber mosaic virus, and Price's 'indicator' strain of the last-named [*R.A.M.*, xiv, p. 5]. These patterns are defined as obtained by 'successive exposures of a plate at different positions along the rear of the camera, with the knife edge set progressively higher and higher with each exposure . . . experimentally, the movement of the photographic plate is synchronized with the movement of the knife edge so that a continuous pattern is formed'. The scanning patterns of the above-mentioned viruses are not identical.

Specific scanning patterns were also obtained for healthy Otenashi pea beans [*Phaseolus vulgaris*] and those infected by Zaumeyer's bean virus 4 [southern bean mosaic virus: ibid., xxiii, p. 303; and above, p. 431].

Extracts from healthy tobacco plants contain three proteins, the concentrations and nature of which were not affected by the development of the mosaic virus in the plant. The appearance of the abnormality in the scanning pattern obtained with mosaic virus-infected tobacco plants coincides with the manifestation of symptoms in the plant. Healthy pea bean extracts yielded two proteins.

The scanning patterns obtained with virus-free Green Mountain and Cobbler potato tubers from virus-free seedlings are the same from seedling to seedling, irrespective of the duration of storage. More than one abnormality was observed in the patterns from apparently healthy field-grown tubers. Plants belonging to the same genus produce markedly similar patterns.

Hewitt (W. B.), Houston (B. R.), Frazier (N. W.), & Freitag (J. H.). **Leafhopper transmission of the virus causing Pierce's disease of Grape and dwarf of Alfalfa.**—*Phytopathology*, xxxvi, 2, pp. 117–128, 2 diags., 1946.

The methods and data [*Phytopathology*, xxxii, pp. 8 & 10] on the detection of leafhopper vectors of the viruses causing lucerne dwarf and Pierce's disease of the vine in California and the association of the two diseases in the field are described

[*R.A.M.*, xxi, p. 278], together with the technique and results of intertransmission experiments between the two hosts. Naturally viruliferous individuals of *Draeculacephala minerva*, *Carneocephala fulgida*, *Helochara delta*, and *Neokolla circellata* transmitted both viruses from diseased to healthy plants of the same hosts, and naturally non-viruliferous leafhoppers, after feeding on diseased plants, conveyed the inoculum from infected California Common lucerne to healthy Emperor, Malaga, Molinera, and Thompson Seedless vines and vice versa.

The majority of field collections of *D. minerva*, *C. fulgida*, and *H. delta* were non-viruliferous, whereas 59 per cent. of those of *N. circellata* tested were naturally viruliferous. The incubation period of the virus deemed to be implicated in the etiology of both diseases was under four days in *D. minerva*.

The distribution of vines suffering from Pierce's disease followed two general patterns, (1) irregularly scattered over the vineyard, and (2) concentrated in small areas. In both cases insects were indicated as the agents of transmission, and additional cogent evidence to this effect was afforded by the grouping of diseased vines under insect light traps. The vine disease tended to predominate in the vineyards of localities where lucerne was widely grown, and in the sections of the vineyards adjoining lucerne fields. Under the same conditions dwarf of lucerne was prevalent.

Root pieces from diseased vines inserted into lucerne roots were apparently responsible for the transmission of the virus in 12 out of 35 tests, but lucerne root pieces, similarly introduced into the stems of rooted vine cuttings, failed to transmit the infective principle.

Compte rendu sommaire des travaux poursuivis dans les stations et laboratoires de pathologie végétale. [Brief report on the work done in the stations and laboratories of plant pathology.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 271–283, 1943. [Received April, 1946.]

This review of the work carried out during 1942 [cf. *R.A.M.*, xxv, p. 328] at the plant-pathological stations of Versailles, Montpellier, Antibes, La Grande Ferrade, and Avignon contains the following items of interest, apart from those already noticed from other sources. Experiments on the control of peach leaf curl [*Taphrina deformans*: ibid., xxiv, p. 493; xxv, p. 206] showed that treatment with Bordeaux mixture or lime-sulphur on 24th February at bud-swell was more effective than later. A commercial brand of copper oxychloride used at a dosage of 2 per cent. gave very good results, while a commercial form of barium polysulphide was effective at 8·5 and 3 per cent. *Sphaeropsis pseudodiplodia* was frequently isolated from rotted loquat fruits; the fungus is very common on pomes in the Mediterranean area.

Important losses to eggplants growing in the irrigated alluvial plains in the lower valley of the Var were caused by collar cankers due to *Phomopsis vexans*. Marrow seedlings at Antibes showed necrosis of the cotyledons due to *Choanephora cucurbitarum* [ibid., xix, pp. 133, 513, 514]. Artichokes [*Cynara scolymus*] badly attacked by *Ramularia cynarae* produced only few and small heads.

Good results against wheat bunt [*Tilletia caries* and *T. foetida*] were obtained at the Central Station by seed treatments with chloronaphthol dip at 20 per 1,000, mercaptobenzothiazol dip at 20 per 1,000, chloromercuriphenol dust at 20 per 10,000, trioxymethylene 50 per cent. and talc (200 gm. per 100 kg. seed), and with product Cr as dust (200 gm. per 100 kg.), or as a dip at 1 per 1,000.

Italy. **Phytopathological observations.**—*Int. Bull. Pl. Prot.*, xv, 4, p. 67 m, 1941. [Received July, 1946.]

The Royal Station of Plant Pathology, Rome, reports the following for the first time in Italy: *Oidium hortensiae* [*Microsphaera polonica*: see below, p. 451] on

the inflorescences only of *Hydrangea* plants in greenhouses and a mosaic disease on Précoce argenté peach trees, imported from France and grown near Ravenna. The Bouquetière sour orange (*Citrus vulgaris*) [*C. aurantium*] was proved to be very resistant to 'mal secco' (*Deuterophoma tracheiphila*) [*R.A.M.*, xxiii, pp. 128, 252]. Experiments confirmed the hereditary transmission of brown spot disease ('Eisenfleckigkeit') [internal rust spot: ibid., xxiii, p. 89] of potato tubers, but demonstrated that seasonal conditions exercise a strong influence on the manifestation of this disease.

Bontea (Vera). **Noutati fitopatologice din 1942.** [Phytopathological notes for 1942.]—*Anal. Inst. Cerc. agron. Român.*, xv, p. 208, 1945.

According to an abstract of a paper read before the Rumanian Institute of Agricultural Research in January, 1943, sharp attacks of *Cladosporium cucumerinum* on cucumber, leaf mould of tomato (*Cladosporium fulvum*), and *Fusarium* wilt of cineraria were noted in Rumania in 1942. *Sporodesmium* [*mucosum* var.] *pluriseptatum* was serious on cucumber leaves; the association of *Cercosporina anethi* and *Phoma anethi* [*R.A.M.*, xvii, p. 771] was observed for the first time in Rumania, causing a blackening of apple stems; *F. oxysporum* caused a wilt of bullock's eye plants; black scab [wart disease] of potatoes (*Synchytrium endobioticum*) was recorded [apparently for the first time for Rumania: cf. ibid., xv, p. 252]; and a gummosis of sugar beet was produced by *Bacillus betae* [ibid., xxiii, p. 465].

Ciccarone (A.). **Italian East Africa. Plant diseases reported in 1939.**—*Int. Bull. Pl. Prot.*, xiv, 6, pp. 117 M–119 M, 1940. [Received July, 1946.]

In the note preceding this list of plant diseases [some of which are new] observed in [former] Italian East Africa in 1939, it is stated that [in Abyssinia] serious damage was caused to wheat by *Puccinia graminis*, *P. glumarum*, and *P. rubigo-vera* [*P. triticina*]; broad beans were appreciably affected by *Uromyces fabae*, haricot beans [*Phaseolus vulgaris*] by *U. appendiculatus*; and native flax by *Melampsora lini*. Economic losses were caused by the sorghum smuts *Sphacelotheca sorghi* and *S. cruenta*. *Oidium erysiphoides* [? *Erysiphe polygoni*] was frequent on green peas, lupins, broad beans, haricot beans, and sesame.

Bensaude (Mathilde). **Rapport entre la distribution des bactéries et la flétrissure, dans les plantes parasitées par le Corynebacterium sepedonicum (Spieckermann et Kotthoff) Skaptason et Burkholder. Multiplication et migration du Corynebacterium sepedonicum dans les tissus des plantes infectées. Notes préliminaires.** [Relation between the distribution of bacteria and wilt in plants parasitized by *Corynebacterium sepedonicum* (Spieckermann & Kotthoff) Skaptason & Burkholder. Multiplication and migration of *Corynebacterium sepedonicum* in the tissues of infected plants. Preliminary notes.]—*Bol. Soc. broteriana*, Sér. 2, xx, pp. 5–31, 1946.

Greenhouse and field observations on some 40 Bonny Best tomato plants and 20 potatoes of different varieties, susceptible to bacterial wilt (*Corynebacterium sepedonicum*) at Aroostook Farm, Presqu'ile, Maine, confirmed Sherf's conclusions [*R.A.M.*, xxiii, p. 314] that invasion of the root system predominates under relatively cool conditions, while rising temperatures are accompanied by infection of the aerial organs.

The form of wilt described by Haasis from California [ibid., xix, p. 428] and also occurring in Maine appears to arise from the mass destruction of the rootlets, and there are usually no bacteria in the wilted portions of the plants. On the other hand, the wilting symptoms recorded by Saville and Racicot from Canada [ibid.,

xvi, p. 628] and Larson from the United States [ibid., xxiv, p. 164], which agree with those induced by the writer in greenhouse inoculation tests, develop exclusively in parasitized organs and apparently result from bacterial toxins or the dissolution of the phloem tissues at the sites of penetration. When the organisms invade stems or roots already provided with a well-developed secondary xylem, they remain virtually confined to the inoculated vessels and the secondary parenchyma, no necrotic cavity is formed in the phloem parenchyma, and no external symptoms of infection appear. The rootlets produced by diseased roots are flaccid and often reduced to a tubular pellicle.

Further studies on fixed and stained sections of stems, petioles, and roots of inoculated tomato plants showed that the parenchymatous tissues most favourable to bacterial multiplication—the only ones, in fact, subject to spontaneous invasion—are the phloem and xylem parenchyma. In these regions there are either no intercellular spaces or small ones filled with a solution of diffusible organic substances, thus differing from the air-filled interstices of the cortical parenchyma. However, even in such favourable sites spontaneous penetration and active multiplication of the bacteria occur only when they are in more or less direct contact with the functional vessels of the xylem. It would thus appear that the cell walls of the parenchymatous tissues must be actually imbibing the crude sap in order to promote active bacterial development. Possibly the crude sap contains the mineral elements, absent or insufficient elsewhere, which Skaptason has shown [ibid., xxiv, p. 337] to be indispensable to the growth of *C. sepedonicum*.

In conclusion, attention is drawn to the striking histopathological analogies between the potato and tomato wilt caused by *C. sepedonicum* and that of lucerne (*C. insidiosum*), as described by F. R. Jones [ibid., viii, p. 313] and Koehler and Jones [ibid., xi, p. 787]. The few differences between the two diseases are attributable rather to the structure and reactions of the several hosts than to dissimilarities between the causal organisms. The rapidity of wilting, even in cases of mild infection by *C. insidiosum*, is probably due to the abundance of gum formed in the vessels, which contributes largely to their obstruction and appears to be altogether absent from potatoes and tomatoes attacked by *C. sepedonicum*.

ARK (P. A.). **Mutation in certain phytopathogenic bacteria induced by acenaphthene.**—*J. Bact.*, li, 6, pp. 699–701, 1946.

Acenaphthene-saturated broth gave rise to permanent mutations in *Phytomonas michiganensis* [*Corynebacterium michiganense*] and *Erwinia carotovora* in experiments at the University of California, Berkeley. In some cells the changes occurred after a fortnight's growth on the medium at 28° C., the variants being detected on agar plates by dilution or streaking. A greyish-white, compact, flat, slowly growing colony of *E. carotovora*, recently isolated from carrot soft-rot, was only slightly pathogenic to the roots of its host, and one mutant of *C. michiganense* failed to attack tomatoes [*R.A.M.*, xxiii, p. 414]. No comparable effect was induced by acenaphthene on *Phytomonas* [*Xanthomonas*] *phaseoli*.

VOELCKER (O. J.). **Annual Report West African Cacao Research Institute, 1944–45.**—30 pp. [1946. Mimeographed.]

On p. 13 of this report a table is given presenting the information so far available on the symptoms produced by eight strains of the cacao swollen-shoot virus [*R.A.M.*, xxv, p. 293] in the Gold Coast. Strain A (New Juaben) causes defoliation, rapid die-back, and usually death of the tree in two or three years. The acute leaf symptoms consist in vein-clearing, red veinbanding, and mosaic. The chronic leaf symptoms are small, pale leaves, occasional veinbanding (fern pattern), and necrosis. The stem symptoms take the form of swellings and die-back. The

latent period is 120 days for the leaf symptom and 150 for the stem swellings. Strain B (Bisa) produces no effect on general health. The acute leaf symptoms consist in slight chlorosis, and there are no chronic ones. The stem symptoms are large swellings, and the latent period for these is 118 days. Strain C (Kpeve) results in reduced leaf production and stunting. The acute leaf symptoms are vein-clearing and red mottle, and the chronic are yellow mottle, necrosis, crinkle, and dark green veinbanding. No stem symptoms are present. The latent period for the leaf symptom is 114 days. Strain D (Nkawkaw) causes reduced leaf production and stunting. The acute leaf symptoms are red mottle and yellow flecking, and the chronic are occasional veinbanding. The stem symptoms consist in slight swellings and stunting. The latent period is 120 days for the leaf symptom and 360 or more for the stem swellings. Strain E (Pamen) causes reduced leaf production and stunting. The acute leaf symptoms are yellow flecking and the chronic yellow mottle (oak-leaf) and faint red veinbanding. The stem symptoms are medium swellings. The latent periods are 143 and 300 days for the leaf symptom and stem swellings, respectively. Strain F (Wiawso) causes defoliation, slow die-back, and premature death. The acute leaf symptoms are red veinbanding and vein-clearing, and the chronic are yellow veinbanding. The stem symptoms are large swellings and die-back. The latent periods are 124 and 360 or more days for the leaf symptom and stem swellings, respectively. Strain G (Dochi) exerts no adverse effect on health. The acute leaf symptoms are faint red veinbanding, and the chronic, yellow veinbanding. There are no stem symptoms. The latent period for the leaf symptom is 360 days or more. Strain H (Dawa) produces defoliation, slow die-back, and premature death. The acute leaf symptoms are red veinbanding and vein-clearing, and the chronic are mosaic and necrosis. The stem symptoms are swellings and die-back. The latent periods for the leaf symptom and the stem swellings are 58 and 100 days, respectively.

Out of a large population of healthy mature trees infected by budding with strain A, 44 per cent. were dead 18 months later, while the remainder are not expected to live. Inoculation of healthy trees with either of the mild strains B or C failed to confer immunity when strain A was budded on them a year later. It was demonstrated experimentally that strain A moves from the infected scion into the stock in under 24 days. Ring-barking tests showed that strain A is not generally carried in the xylem, in spite of the effects produced on this tissue. Of 7,278 seedlings from affected trees, none has developed virus symptoms.

The selection of isolated healthy trees in devastated farms has reached a total of 452. Budwood from them has been propagated and then infected with A. A high percentage have had to be discarded, but certain selections, of which five are outstanding, show only a slight check in growth, normal growth then following. These five clones are being rapidly propagated by budding. Good evidence has been obtained that tolerance exists.

So far as is known at present, the outbreaks in Nigeria are small and confined to Oyo Province. It has been reported that in the Ivory Coast [ibid., xxv, p. 295] the disease, though widely distributed in the eastern region, accounts for under 200 acres. Three strains appear to be present, two of which resemble A and F. Sierra Leone, French Togo, French Cameroons, and [French] Equatorial Africa appear to be unaffected.

Cutting out infected trees and apparently healthy contact trees eliminated the disease from 76 per cent. of outbreaks where there were fewer than ten infected trees and from 30 per cent. of those where there were ten or more. Eighteen of the outbreaks were re-treated once or more after the reappearance of the disease, and 15 of these re-treated outbreaks showed no sign of the disease two years afterwards. The loss of trees from 1939 to 1945 where cutting-out was practised

was ten times less than in an adjoining area of one square mile of comparable trees where no control was carried out.

KIŠPATIĆ (J.). **Über ungleiche Beizempfindlichkeit der Sporen verschiedener Brandpilze.** [On the unequal susceptibility to disinfectants of the spores of different smut fungi.]—*Phytopath. Z.*, xiv, 5, pp. 522–523, 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, pp. 44–45, 1944. Received March, 1946.]

The spores of wheat bunt (*Tilletia tritici*) [*T. caries*], barley covered smut (*Ustilago hordei*), loose smut of oats (*U. avenae*), and millet smut (*Sphacelotheca panici-miliacei*) were immersed for half an hour in abavit liquid 3330a, ceresan U. 564, fusariol liquid 2115a, and germisan liquid retort 3659 I, rinsed six times in distilled water, dried, and laid out for germination, those of the first-named species on liquid mud at 11° and of the others on 2 per cent. saccharose at 20°. The *doses curativae* in the case of *T. caries* were approximately the same for all the fungicides, but marked fluctuations were apparent in the resistance to treatment of the other smuts. For instance, ceresan, fusariol, and germisan had to be applied at twice as high a concentration against *S. panici-miliacei* as against *T. caries*, while conversely a much smaller quantity of abavit was required to inhibit the former smut than that needed for the latter.

CRÉPIN (C.). **Quelques enseignements à tirer des campagnes précédentes dans la culture du Blé.** [Some lessons to be drawn from the cultivation of Wheat in previous seasons.]—*C.R. Acad. Agric. Fr.*, xxvii, 1, pp. 42–50, 1941. [Received August, 1946.]

In discussing the effect of weather conditions on wheat in France between 1927 and 1941, the author states that in July 1940, when the plants still required six weeks' favourable weather to ripen normally, a period of incessant rain induced an exceptionally severe epidemic of *Puccinia graminis*, which involved almost the whole of France. The fungus appears nearly every year as a few pustules on the stems as the wheat matures, but in such conditions causes no damage and is not noticed. But in 1940, as in 1936, 1931, and 1930, which were all rainy years, the disease appeared earlier, when the wheat was far from mature. The effects of the outbreak were disastrous. In central France, fields which should have produced 20 ql. weighing 75 kg. per hl. gave only 10 or 12 ql. weighing 65 kg. or less per hl. In the north, fields which normally yield 35 to 40 ql. of full grain gave 20 to 25 ql. of grain weighing only 70 kg. per hl. The total loss was enormous.

All varieties are susceptible but, among heavy yielders, Préparateur Étienne is least so. To escape the disease as far as possible every effort should be made to ensure that the wheat reaches maturity at the normal time. The use of early varieties resistant to cold is advised. If sowing after January is unavoidable, varieties that ear easily when sown on the date selected should be used.

SĂVULESCU (T.). **Wheat rusts and Wheat scald during the year 1940. I. Rusts.**—*Int. Bull. Pl. Prot.*, xv, 10, pp. 181 M–185 M, 1 map, 1941. [Received July, 1946.]

During the autumn of 1939, wheat in Rumania developed light sporadic infection by brown rust (*Puccinia triticina*) [cf. *R.A.M.*, xxi, p. 249]. Towards the end of June, 1940, the disease was moderately severe in the Titu region, and at the conclusion of the growing period heavily attacked wheat in the Danubian Plain, from Feteşti to Oltenița and up to the Station of Bărăganul, Mărculești (Ialomița Department). During the summer, attack by *P. graminis* was moderately intense in the Danubian Plain, Moldavia, and middle of Bessarabia, somewhat less so in Oltenia, and slight in Banat and Transylvania.

Peyronel (B.). **A proposito di un caso di deperimento di Frumento coltivato su prato naturale dissodato.** [On a case of dying-off of Wheat cultivated on ploughed natural meadowland.]—*Nuovo G. bot. ital.*, N.S., xlix, pp. 290–292, 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 44, 1943. Received March, 1946.]

As a war-time measure, an area of natural meadowland in a Turin park was partially planted with potatoes and after these were lifted in the late autumn the whole was sown with wheat. In the portion of the field formerly occupied by the potato crop, the wheat sustained no appreciable parasitic injury, but in the other part it was severely attacked, notably by *Calonectria graminicola*, which occurred in a relatively mild form on the meadow grasses. The enhanced susceptibility of the wheat to fungal infection is attributed to its cultivation on an uncongenial soil.

Marchionatto (J. B.). **Argentine Republic. An epiphytotic of Wheat septoriosis.**—*Int. Bull. Pl. Prot.*, xv, 6, pp. 113 M–114 M, 1941. [Received July, 1946.]

Wheat in the Argentine Republic is attacked by *Septoria tritici* [*R.A.M.*, xxiv, p. 12] and *S. nodorum* [ibid., xxiv, pp. 222, 402, 445], the latter being the more serious. The disease, though present for many years, did not become of importance until latterly. It was observed in the vicinity of Pergamino and was subsequently found on several wheats in Buenos Aires, Santa Fé, Córdoba, and Entre Ríos. In 1939 it also occurred in Uruguay. Early varieties, sown from April to June, are the most susceptible. Disease development is favoured by mild temperatures, but for heavy attacks abundant rainfall is necessary.

Greaney (F. J.). **Influence of time, rate, and depth of seeding on the incidence of root rot in Wheat.**—*Phytopathology*, xxxvi, 4, pp. 252–263, 1946.

In field experiments in Manitoba from 1936 to 1939, inclusive, the incidence of root rot (*Helminthosporium sativum* and *Fusarium* spp.), the most widespread and destructive disease of spring wheat in the Province [*R.A.M.*, xxiii, p. 96], was reduced and the yield increased by early sowing. Thus, mean seedling root-rot ratings for the four years, using the Pentad variety in the two former and Mindum in the two latter, rose from 45·5 (where 0 = no disease and 100 = the maximum) for the 7th May sowing to 60·8 for that of 12th June, the corresponding figures for adult plants being from 30·8 to 56. During the same period the yields were 35·7 and 16·8 bush. per acre. Only in the plantings subsequent to 31st May was there an appreciable decline in the percentage of seedling emergence, which by 12th June had sunk to 58·8 per cent. compared with 67·8 for the 7th May sowing and 66·2 for that of 31st May. A clear-cut correlation was established between soil temperature and root rot in the date-of-sowing tests, the slight incidence of infection and heavy yields in the early-sown plots being associated with low mean daily temperatures (43·5° F. on 7th May), while the high temperatures of the later dates (50·7° on 12th June) were an important factor in the increase of disease and fall in yield.

From 1938 to 1940, inclusive, the amount of root rot rose progressively with increases in the sowing rate of Regent wheat from 50 to 500 seeds per 18-ft. row, the mean percentage of diseased plants at the former and the latter densities being 65·3 and 97·7, respectively, and the adult plant root-rot ratings 11·7 and 29·7, respectively. However, in spite of the consistently upward trend of the disease with increased sowing rates, the average yield for the three years rose from 18 bush. per acre at 50 to 32·7 at 500.

In tests in 1943 on the Thatcher and Red Bobs varieties, and in 1944 with the same two, Renown, and Regent, the severity of root rot increased with depth of planting (1 to 4 in. in the former and 1 to 3 in the latter year). The mean root-rot

ratings in 1943 for the 1-, 2-, 3-, and 4-in. depths were 15·3, 21·6, 23·1, and 24, respectively, and in 1944 for 1-, 2-, and 3-in. 17·5, 20·9, and 24·6, respectively.

It is evident from these results that root-rot losses in Manitoba can be reduced by relatively sparse and shallow sowing at the earliest feasible date.

GLYNNE (MARY D.). **Eyespot of Wheat and Barley in Scotland in 1944.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 35–39, 1946.

Although considerably more wheat and barley were grown in Scotland during the war, the long rotations practised there usually include these crops less often than those of southern England. This tends to prevent more widespread incidence of eyespot (*Cercosporella herpotrichoides*) [*R.A.M.*, xxi, p. 521] in Scotland, but it was, nevertheless, detected in 90 out of 121 autumn-sown wheat crops distributed over 12 counties in August, 1944. In 40 fields the infection was sufficiently great to endanger subsequent crops and 11 crops were showing considerable loss. Seventeen out of 18 spring-sown barley crops were similarly attacked, with more than 50 per cent. straw infection in seven. Lodging, mostly due to eyespot, was observed in about 4 per cent. of the wheat inspected, and in about 38 per cent. of the barley, mostly as the result of non-parasitic agencies. The more humid atmosphere of Scotland favours the development of eyespot, and in 1944 the rainfall from April to July varied from 8·9 to 11·2 in. in eight counties. Frequent inclusion of cereals in the rotation increases the incidence of eyespot, which tends in Scotland to thrust higher up the straw and to infect spring-sown barley more severely than in southern England. Fairly severe outbreaks of eyespot were found, however, in a few fields where wheat and barley had not been grown for some years. It is also thought that close cereal cropping, which promotes the spread of eyespot, may be a factor discouraging the increase of wheat-growing in the damper areas of Scotland.

Take-all (*Ophiobolus graminis*), which was more common than eyespot in the counties of Dumfries and Aberdeen, was detected in 52 of the wheat crops, although only one had as much as 10 per cent. infection and most had less than one.

Sharp eyespot (*Corticium solani*) was most common in Aberdeenshire and was found in eight other counties, 34 crops in all being infected, mostly less than 1 per cent.

FREISLEBEN (R.) & LEIN (A.). **Über die Auffindung einer mehltauresisten Mutante nach Röntgenbestrahlung einer anfälligen reinen Linie von Sommergerste.** [On the detection of a mildew-resistant mutant after Röntgen irradiation of a susceptible pure line of summer Barley.]—*Naturwissenschaften*, xxix, p. 608, 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 43, 1943. Received March, 1946.]

Air-dry seed-grain of a pure line of Haisa, one of the most prolific summer barleys *Hordeum distichum* var. *mutans*) was exposed to Röntgen rays at dosages of 4,000 to 14,000 r. In 1941–2, 12,000 X_1 progeny and 24,000 seedlings were tested in the greenhouse for their reaction to mildew [*Erysiphe graminis* var. *hordei*: *R.A.M.*, xxiv, p. 185] by a new mass-inoculation technique: of the plants from irradiated seed 19 were more or less resistant. Among the X_2 progeny inoculated in the field in 1942 was an absolutely mildew-free, vigorous, dark green plant, the fully fertile and otherwise normal X_3 offspring of which proved to be homozygous-resistant to physiologic races 1, 2, and 4 of the fungus.

PETRI (L.). **Recenti ricerche sul 'mal secco' degli Agrumi in Turchia.** [Recent researches on 'mal secco' disease of Citrus in Turkey.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 81–98, 1940. [Received June, 1946.]

Discussing the researches of Gassner into citrus 'mal secco' disease (*Deuterophoma tracheiphila*) in Turkey [*R.A.M.*, xx, p. 398] in relation to observations

made by himself and other workers, mostly in Sicily [ibid., x, p. 182; xviii, p. 245], the author points out that whereas in Turkey the tangerine is more resistant than sweet orange, in Sicily and Calabria the reverse obtains. Furthermore, young sour orange trees are more susceptible than adult ones, though the reverse holds in Turkey. *D. tracheiphila* can hardly be identical with *Phoma limoni*, for the latter was reported in 1887, whereas 'mal secco', which is always accompanied by *D. tracheiphila*, since its discovery in eastern Sicily in 1918 has spread in turn to Syracuse, Palermo, and Reggio Calabria. The disease certainly reached Greece from Asia Minor and Palestine, and in its spread westwards and southwards the damage caused has become progressively worse. The author has on many occasions observed a species resembling *P. limoni* on citrus twigs with dried tips and evidently damaged by wind, but this species was a saprophyte or a weak parasite. The pycnidia of *P. limoni* are easily visible externally, whereas those of *D. tracheiphila* are not, even with a lens. They are always covered by the epidermis, which assumes an ashy colour; this is a diagnostic character of the fungus. Further, they measure 35 to 50 μ in diameter (exceptionally, 80 to 90 μ), whereas, in Italy at least, those of *P. limoni* are 60 to 135 μ. Penzig's description and figure show the pycnidia to be depressed and ostiolate, whereas those of *D. tracheiphila* are mostly globose, seldom lentiform, and only a few at maturity present a slight thickening which might be a trace of an ostiole. There is, finally, no relation between *P. limoni* and the incidence of 'mal secco', since the fungus is present where the disease has never appeared. The strain of *Deuterophoma* attacking citrus in Turkey may well differ slightly from that found in Sicily and Greece.

It is inexact to say that the symptoms described for 'mal secco' before Gassner's paper appeared included those caused by frost as well as those due to *D. tracheiphila*. The symptoms described for Sicily at least have nothing to do with frost. Gummosis of the cambium, which is always present in herbaceous twigs after infection by *D. tracheiphila*, and is attributed by Gassner exclusively to frost predisposing the plant to fungal infection, is always in Sicily and Calabria (whatever may be the case in Turkey) due directly to infection, as has been shown in inoculation experiments where no frost injury was present. Such primary infections of the shoots are of frequent occurrence in Sicily during autumn, at which season no damage from frost has ever been known locally; and even in these infected shoots gummosis of the cambium is often present. Gum infiltrations in the woody vessels of the branches and stems have never been regarded by the author as specific symptoms of 'mal secco', though he noted them as accessory pathological characters often attributable to causes other than the disease. To the internal symptoms of true 'mal secco' listed by Gassner gummosis of the cambium of the green branches must be added, though it may, possibly, sometimes be due to frost also. Finally, 'mal secco' is markedly contagious, independently of cultural and environmental conditions.

What Gassner terms 'brown mal secco' evidently corresponds with the form of the disease found by the author in Greece, in which the woody tissue is not the usual orange-red, but brown. The mycelium of *D. tracheiphila* isolated from such branches did not form a red pigment, but in its other characters the fungus was identical with the chromogenous form. According to Gassner, this brown discoloration is due to frost damage only, not to true 'mal secco'. The author's view is that frost damage may be present in such cases, but only as an accessory factor to infection by *D. tracheiphila*. The frost damage in the cambium described so exactly by Gassner has not been observed in Sicily.

Cold does not predispose the trees to primary infection in Sicily and Calabria, and here sour orange is more resistant to cold than sweet orange but markedly susceptible to 'mal secco', while sweet orange is definitely resistant; tangerine is more resistant to cold than sweet orange, yet less resistant to 'mal secco'. It may

be that the Turkish lemon, Mola Mehmed, being more resistant to cold, is also more resistant to 'mal secco', but this does not apply to the Interdonato or the Monachello lemon.

The author concludes that the infective nature of the disease is confirmed, though he and Gassner differ on the systematic identity of the fungus, and on the conditions which predispose the trees to infection.

Bliss (D. E.). **The relation of soil temperature to the development of Armillaria root rot.**—*Phytopathology*, xxxvi, 4, pp. 302–318, 7 figs., 1 graph, 1946.

This is a report on a series of six soil temperature tests at the Citrus Experiment Station, Riverside, California, designed to yield further information on the environmental factors affecting the root rot caused by *Armillaria mellea* on the following nine economic and ornamental plant species: Koethan and Homosassa sweet and Standard sour orange [cf. *R.A.M.*, xxiv, p. 225], Sampson tangelo (*Citrus paradisi* × *C. reticulata*), California pepper tree (*Schinus molle*), *Casuarina stricta*, Lovell peach, Royal apricot, *Pelargonium hortorum*, and Ragged Robin rose. The plants were inoculated with the pathogen and grown for 181 to 438 days in the greenhouse in five soil-temperature tanks, the water baths in which were maintained at different controlled temperatures, ranging approximately from 7° to 38° C. The air temperatures in the greenhouse ranged mostly from 21° to 27°.

The optimum temperatures for root growth in uninoculated peach, *C. stricta*, *S. molle*, *P. hortorum*, and apricot (group A) fell between 10° and 17°, and those for citrus and rose (B) between 17° and 31°. The top growth of citrus was greatly retarded at soil temperatures of 10° to 12°, the new leaves being small and very chlorotic, and stimulated to maximum production at 27° to 31°. The minimum and maximum temperatures for root growth were 12° and just below 38°, respectively. All the peach, apricot, and *P. hortorum* plants died at 38°, the maximum production of top growth by the first two occurring at 31° and the minimum at 10°, while the corresponding figures for the last-named were 17° and 31°, respectively. The top growth of *S. molle* was delayed at 10° but was vigorous and of almost equal luxuriance at 15° to 30°. The growth rate of roses was accelerated from 8° to 28°. The top growth of *C. stricta* fell to a minimum at 7° and reached a maximum at 27°.

The rhizomorphs of *A. mellea* developed most rapidly in sterile, deep nutrient agar at 19·7° and 24°, a decrease in the growth rate being observed at 10°, 14·6°, and 27·4°, while only slight growth was made at 31° and 5°, and none at 36°. The pathogen remained viable in inoculum within the controlled temperature range of 7° to 28° throughout the test periods of 181 and 438 days, after which lengthy periods the maximum rhizomorph development in non-sterile potting soil was made at the lowest experimental temperatures. No explanation is forthcoming of the apparent inconsistency in the effect of temperature on rhizomorph development on agar and in soil.

Root-rot symptoms were observed in the test plants at a soil temperature range of 7° to 25°, with an optimum for pathogenesis in group A from 15° to 25° and in B from 10° to 18°. All the plants exerted their maximum resistance to infection at temperatures most propitious to root growth. In any host of *A. mellea* there are two critical temperatures for root-rot development, one at each extremity of the range for pathogenesis. Of these the upper limit, round about 26° for all the species used in these tests, is the more important. In southern California the prevalence of the disease throughout the coastal regions, and its presumed absence from the inland desert areas, appear to be related to differences in soil temperature, which largely exceeds 26° at 1- to 4-ft. depths at Indio (desert) for three months of the year, whereas at Anaheim, on the coast, it seldom reaches this point. In the latter district, pathogenesis among the representatives of group A would be

expected to develop at the maximum rate from the spring to the autumn, and among those of B from the late autumn to the spring.

Leach (R.). **The unknown disease of the Coconut palm in Jamaica.**—*Trop. Agriculture, Trin.*, xxiii, 3, pp. 50–60, 5 pl., 1 graph, 2 maps, 1946.

Detailed researches by the author, supplemented by visits to Trinidad, British Guiana, and Haiti, have convinced him that the disease of the coco-nut palm, known locally in Jamaica as 'west-end bud rot' and considered by Briton-Jones [*R.A.M.*, xx, p. 111] and Bain [ibid., xx, p. 200], but doubtfully by Martyn [ibid., xxiv, p. 367], to be identical with the bronze-wilt disease, is distinct from that malady. He prefers to designate it, pending the results of further study, as 'the unknown disease'.

The following symptomatological differences between the unknown disease and bronze wilt are pointed out. There is no foliar discoloration in the former throughout the nut-fall period, at the onset of which nuts of all sizes fall particularly on one side of the tree, whereas a definite bronzing and yellowing of several leaves is a first symptom of bronze-wilt disease and the youngest nuts fall first with no such unilateral abscission. When bronzing becomes obvious in the former, there are no nuts left on the palm, while there may be many on severely bronzed palms in the latter; discoloured inflorescences are a primary symptom in the unnamed disease, and five spathes may wither before the heart dies, but in wilt they may remain healthy until bronzing is well developed and only two or three may wither before death of the heart. Bronzed leaves in the unnamed disease maintain a normal angle when dry and later fall without drooping down the stem instead of hanging down in close clusters round the stem after drying, as in bronze leaf wilt. In young plants the unknown disease may be diagnosed with certainty if bronzing is accompanied by die-back of the heart leaf.

No likely causal pathogen of the unnamed disease has been isolated and active growth in surface feeder-roots was observed even after all the nuts had fallen, but in the final stages root activity ceased. A species of *Rhizoctonia* (? *R.* [*Corticium*] *solani*), isolated from the junction of healthy and diseased tissues of very young and moribund palms, was inoculated into the base of the young plants, but the resultant rapid infection was soon confined to an area round the point of inoculation. Periodic measurements throughout the growing period showed that in bearing palms leaf growth did not decrease until bronzing appeared, that nut growth slowed soon after infection, and that diseased spathes opened rapidly.

Leaf growth of young diseased plants is arrested so suddenly that early stages of the disease can be more accurately estimated by noting their rate of growth than from any change in foliage colour, for bronzing may not occur until leaf growth has almost ceased.

The data collected suggest that the disease is favoured by seasonal conditions which encourage vigorous growth and not by those causing physiological die-back of the roots through drought or waterlogging. As in the case of bronze wilt, the more luxuriantly the palms grow, and the better their yielding capacity, the more susceptible they seem to be to the disease. On the other hand, very few new cases were recorded, at the height of the drought, in contradistinction to bronze wilt.

The fact that different rates of incidence distribution have been observed on different soils, whereas on uniform soils the spread is uniform, inclines the author to consider that this may be due to the varying nutrient status of the plants growing on different soils. The disease appears unable to spread over short distances.

In Haiti the Department of Agriculture have known of the disease for the past 15 to 20 years around Cap Haitien and Port de la Paix and there are references to what would seem to be the same malady in the Cap Haitien area as far back as 1880. In two years from 1943, however, the disease developed with a virulence

surpassing that of Jamaica and 8,000 coco-nut-bearing palms were killed in and around the town of Gonaives. Its appearance has been reported in the Grande Rivière valley and round Plaisance, the mild incidence being possibly attributable to the palms there being scattered among coffee and banana plantations, whereas those at Gonaives are densely set. The soil round Gonaives is highly alkaline, and that round Limbe free-draining and slightly acid, which weakens any theory of soil deficiency as a possible causative factor, and while young plants on the northern plain are not affected until they reach the bearing stage, they acquire the disease at Gonaives when much younger. At Gonaives mortality of date palms (*Phoenix dactylifera*) and some royal palms (*Roystonea oreodoxa*) has occurred, starting with the withering of the lower leaves and the inflorescences and rotting of the heart leaves, symptoms recalling the rhizosis of date palms in California described by Bliss [ibid., xxi, p. 195] and associated with the fungus *Ceratostomella radicicola*. It is impossible to say at present whether the disease is the same as that attacking the coco-nut.

M[AYNE] (W. W.). **Hemileia vastatrix in India.**—*Plant. Chron.*, xl, 23, pp. 384–387, 1946.

Three major reasons are adduced for the survival of the Arabica coffee industry, notwithstanding the presence of leaf rust (*Hemileia vastatrix*) in South India, where the crop covers 200,000 acres, with approximately 75 per cent. in the Western Ghats of Coorg and Mysore. (1) The seasons are more strongly marked in South India than in Ceylon, where the disease caused the collapse of the industry, with a clearly defined dry season from late November to mid-March. (2) In South India coffee has been consistently cultivated under a practically continuous shade canopy, which influences leaf rust directly by checking spore dissemination and indirectly by reducing light intensity and diurnal temperature fluctuations and generally providing unfavourable conditions for the fungus. (3) The Kents strain of coffee cultivated in South India since the 1920's is more resistant to leaf rust than Coorg, which in the 1880's superseded the original strain planted from 1840 to 1860, but gradually lost its capacity to withstand the disease. The writer's studies have shown that the differing reactions to *H. vastatrix* of the two varieties rest on the existence of physiologic races of the rust [*R.A.M.*, xv, p. 798].

SIMPSON (D. M.) & WEINDLING (R.). **Bacterial blight resistance in a strain of Stoneville Cotton.**—*J. Amer. Soc. Agron.*, xxxviii, 7, pp. 630–635, 1946.

A strain of upland cotton, U.S.D.A. Stoneville 20, has been isolated which is highly resistant to natural and artificial infection by bacterial blight (*Xanthomonas malvacearum*). The resistant character has been transmitted to selections from Stoneville 20 hybrids and the susceptible Stoneville 4 and Trice A varieties and to their back-crosses, thereby opening up a hopeful prospect for the introduction of this factor into varieties adapted to production in different sections of the Cotton Belt. By means of a simplified adaptation of Knight and Clouston's method of field inoculation [*R.A.M.*, xviii, p. 796], providing epidemic conditions in the breeding plots, plants may be selected with reasonable certainty as to their resistance to the disease.

WEBB (SHIRLEY). **Australian ambrosia fungi. (Leptographium lundbergii Lagerberg et Melin, and Endomycopsis spp. Dekker).**—*Proc. roy. Soc. Vict.*, N.S., lvii, 1–2, pp. 57–80, 1 pl., 8 figs., 1946.

This paper includes a full account of the fungus *Leptographium lundbergii*, which together with two species of sporogenous yeasts belonging to *Endomycopsis* was constantly isolated from the tunnels of the Australian ambrosia beetle *Platypus*

subgranosus in *Nothofagus cunninghamii* and two other timbers. An affinity is suggested between *L. lundebergii* and *Ceratostomella ips*. It is conceivable that the *Endomycopsis* spp. serve the beetle as food or assist indirectly by stimulating *L. lundebergii* and in this connexion it is noted that Miss Rumbold [*R.A.M.*, xx, p. 551] found yeasts were the first organisms to appear round beetle galleries, blue-stain fungi only developing later.

Régnier (R.). **Résultats de l'enquête et des récentes recherches sur les Hannetons.** [The results of the inquiry into and of recent researches on Cockchafers.] —*C.R. Acad. Agric. Fr.*, xxvii, 5, pp. 325–344, 1941. [Received August, 1946.]

In this study on the damage done by cockchafers (chiefly *Melolontha melolontha*) and their control in France the author states that attempts to destroy them by inoculation with *Isaria* [*Beauveria*] *densa* [*R.A.M.*, xvi, p. 531; xxii, p. 480] have given only partial and irregular results, since the conditions in which the fungus develops have not yet been ascertained. Trials with bacteria have also been carried out, but the results are not yet known (1939). The natural action of *B. densa* was, however, found to be very extensive in argillaceous soils of average humidity, especially in certain fields, where mortality of larvae in the spring of 1940 reached 90 per cent. Attempts at laboratory contamination were invariably successful in the same soils, but failed in soils that dried quickly. Further work is planned.

Paillot (A.). **Rôle des facteurs microbiens dans la destruction naturelle de la Cochylis et de l'Eudémis de la Vigne.** [The part played by microbial factors in the natural destruction of Vine *Cochylis* and *Eudemis*.] —*C.R. Acad. Agric. Fr.*, xxvii, 3, pp. 151–155, 1941. [Received August, 1946.]

In a study of the natural causes of death among the pupae and larvae of the vine moths *Cochylis* [*Polychrosis botrana*] and *Eudemis* [*Clysia ambiguella*] in France, the author found that the commonest fungal parasite of these insects is *Spicaria farinosa* var. *verticillioides* [*R.A.M.*, v, p. 97]. *Citromyces glaber* [*Penicillium glabrum*] was found once only, and *Beauveria bassiana* was also observed. *Verticillium heterocladum* [ibid., xi, p. 641] was encountered more frequently than either *P. glabrum* or *B. bassiana*, but plays only an unimportant part in natural control. About 30 per cent. of the larvae and pupae were mummified by fungal infection. The spread of *S. farinosa* var. *verticillioides* may become reduced as a result of hyperparasitism by *Melanospora parasitica* [ibid., xxv, p. 113], which was also observed by the author.

Loughnane (J. B.) & McKay (R.). **Observations on the pasmo disease of Flax and on the causal fungus Sphaerella linorum Wollenweber.** —*Sci. Proc. R. Dublin Soc.*, N.S., xxiv, 10, pp. 89–98, 4 pl., 1946.

The symptoms of the 'pasmo' disease of flax (*Sphaerella linorum*), first detected in Eire in 1944 [*R.A.M.*, xxiv, p. 102], are described as they affect the cotyledons, stems, leaves, sepals, pedicels, and internal parts of the boll. Inoculation experiments on the Liral Crown variety with a monospore culture of the fungus from *Linum angustifolium* confirmed the existence, already observed by other workers, of a phase of high resistance to infection between the cotyledonary and flowering stages.

An interesting feature of the germinated pycnospores is their capacity for anastomosis, the significance of which is not clear. Another type of germination was observed in which the pycnospore budded off an elliptical secondary spore 10 μ in length, the latter becoming detached and germinating in turn by the

production of a slender germ-tube at either end or both. Viable chlamydospore-like elements, similar to those described by Brentzel from the United States [ibid., v, p. 366], were also detected in the present studies intermingled with the pycnospores both from old cultures and from diseased stems, seeds, and boll tissue.

Seed infection by the formation of mycelium and pycnidia in the seed coat was demonstrated for the first time, the pathogen apparently passing from the sepals to the pedicel, thence to the placenta, and reaching the seed through the funicle. Sections through diseased seeds revealed pycnidia exclusively in the immediate vicinity of the hilum. The pycnidium was found to arise as a stroma between the round cells and the fibrous layers of the seed coat, pushing the former outwards as it expands so that they lie along the pycnidial wall. The epidermal layer, permeated by the mycelium, is finally penetrated by the enlarging pycnidium. There was no conclusive evidence of invasion through the fibrous layers of the seed coat, and no trace of damage to the endosperm or cotyledons; hence, no doubt, the normal germination even of heavily infected seed.

When seed from infected bolls was placed in a germinator at room temperature, 80 per cent. germinated of which 20 per cent. developed pycnidia of *S. linorum* on the coats. A fortnight later half the infected seedlings showed cotyledonary lesions, on which pycnidia were subsequently formed. In another test 100 seeds from the same source as the foregoing were sown in a pot of sterilized soil under glass, and three weeks later two of the 92 per cent. that germinated showed typical lesions on the cotyledons; in another three days two more seedlings were similarly affected, and in due course pycnidia developed on all the spots, leaving no doubt as to the origin of infection in the seed.

The possible modes of overwintering of the pasmo fungus are discussed. In the writers' opinion initial outbreaks of the disease in Eire are attributable mainly to the presence of mycelium and pycnidia in the seed coat.

Fuller (W. H.) & Norman (A. G.). **Biochemical changes involved in the decomposition of Hemp bark by pure cultures of fungi.**—*J. Bact.*, l, 6, pp. 667–671, 1945.

At the Iowa Agricultural Experiment Station the rate of decomposition and biochemical changes in hemp bark inoculated with pure cultures of *Alternaria*, *Hormodendrum*, *Fusarium*, *Phoma*, *Trichothecium roseum*, and *Cephalosporium* [*R.A.M.*, xxiv, p. 191], all dominant fungi on field-rotting hemp, were investigated after incubation periods of 5, 10, and 20 days. During the first ten days, the several organisms caused roughly equal losses in total weight, but subsequently *Alternaria*, *Cephalosporium*, and *Fusarium* were the most active agents of decomposition. Both polyuronide and pectin were vigorously attacked during the first five days, but there was little disorganization of cellulose until the later stages, *Cephalosporium* being somewhat more aggressive in this respect than the other fungi under observation, with a residue of 52·3 gm. per 100 gm. original unretted bark after 20 days as against 54·6 to 59·1 for the remaining organisms and 72·1 for the uninoculated control samples.

[This information is also presented in *Res. Bull. Ia agric. Exp. Sta.* 344, pp. 940–942, 1946.]

Reichert (I.). **Palestine. Diseases of ornamental plants.**—*Int. Bull. Pl. Prot.*, xiv, 10, pp. 181 M–192 M; 12, pp. 229 M–238 M, 1940. [Received July, 1946.]

This is a preliminary list, in the compilation of which the author was assisted by M. Chorin, G. Minz, J. Perlberger, and F. Littauer, of the fungal, bacterial, non-parasitic, and undetermined diseases of ornamental plants in Palestine, studied at the Agricultural Research Station, Rehovot, from 1923 to 1938.

Servazzi (O.). **Brevi note su alcune non communi malattie fungine di piante ornamentali.** [Brief notes on some uncommon fungal diseases of ornamental plants.]—*Boll. Lab. sper. R. Ossv. Fitopat., Torino*, xviii, 1–4, pp. 86–112, 3 pl., 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 48, 1943. Received March, 1946.]

The following are unusual records of parasitic fungi on ornamentals in Italy: *Colletotrichum trichellum* var. *araliae* n.var. on *Aralia sieboldii*, *Hyalopsora polypodii* on *Cystopteris fragilis*, *Ascochyta hydrangeae* on hortensia [*Hydrangea hortensis*]. *Diplodia rehmii* on *Pelargonium* spp., *Phyllosticta ocellata* and *Cladosporium elegans* on citrus trees, *Phoma pinoggii* n.sp. on *Gypsophila paniculata*, *Microdiplodia palmarum* on *Kentia forsteriana*, *Phyllosticta westendorpii* on *Mahonia* [*Berberis*] *japonica*, *P. goritiensis* on lilac, *Coniothyrium pallido-fuscum* on *Araucaria excelsa* var. *robusta*, *P. latifoliae* on *Kalmia latifolia*, *Phomopsis aucubae* f. *ramulicola* on *Aucuba japonica* var. *foliis variegatis*, *Macrophoma turconii* n.comb. on *Monstera deliciosa*, *Pirostoma farnesianum* on *Pandanus veitchi*, and *Gloeosporium polymorphum* on *Dracaena hookeriana* var. *latifolia*.

Goidànich (G.). **La 'Microsphaera polonica' Siem. nel Lazio.** [*Microsphaera polonica* Siem. in Lazio.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 2, pp. 161–174, 1 pl., 5 figs., 1941. [Received June, 1946.]

Microsphaera polonica, in its conidial state (*Oidium hortensiae*), was first recorded in Italy in 1932 [*R.A.M.*, xviii, p. 458; cf. above, page 438], in a glasshouse near Florence, on hydrangeas imported from Belgium, and probably infected in their country of origin. In 1934 the conidial stage occurred in glasshouses at Pinerolo and Turin, and in 1936–7 it was found near Florence on outdoor hydrangeas. The author observed it on forced hydrangeas in a glasshouse in Rome in the winter of 1939, and on glasshouse and outdoor hydrangeas throughout 1940. A feature of the 1940 outbreak was that among hundreds of affected glasshouse plants, while the flowers were severely attacked, the leaves showed little or no infection, only a few small spots being present, with few or no conidia. On the outdoor plants, on the other hand, leaf infection was of average severity. In the author's material, the conidia measured 16 to 45 by 12 to 19 μ. At the date of writing, the perfect state, *M. polonica*, has not yet been reported in Italy. The most susceptible varieties, locally, appear to be Altona, Amburgo, and Europa, while Ulrich, Seidel, and Deutschland are less severely affected.

Cochrane (V. W.). **The common leaf rust of cultivated roses, caused by Phragmidium mucronatum (Fr.) Schlecht.**—*Mem. Cornell agric. Exp. Sta.* 268, 39 pp., 9 graphs, 1945.

In studies on rose leaf rust (*Phragmidium mucronatum*) [*R.A.M.*, xxiv, p. 510], experimental inoculations with a single-uredospore clone of the fungus isolated originally from Hybrid Tea roses from California gave positive results on *Rosa setigera*, *R. carolina*, *R. virginiana*, *R. kamtchatica*, *R. blanda*, and *R. californica*.

The temperature limits for uredospore germination were 6° and 28° C., for aecidiospores 6° and 27°, and for teleutospores 6° and 25°. The optimum range for percentage and rate of germination for uredospores and aecidiospores was 15° to 21°, germ-tube growth being greatest at 18°, which was also the optimum for teleutospore germination.

Evidence was obtained by four different methods indicating that aecidiospore and uredospore germination and infection by uredospores can occur only in the presence of liquid water. Uredospore infection occurred from 9° to 27° (optimum 18° to 21°). Rose plants inoculated with uredospores and kept at 18° in a

moisture-saturated atmosphere for four hours developed some infection, 12 hours permitting the highest degree.

Outdoors, uredospores in lesions on infected leaves showed a maximum longevity of 49 days in the warm, rainy seasons (spring, summer, and autumn), and one of 70 days in winter, indicating that, probably, they do not overwinter at Ithaca, New York. Under controlled conditions of temperature and relative humidity, the longevity of uredospores on stored leaves was greatest at humidities of 25 to 75 per cent. and at a temperature of 3°; the maximum longevity (over 365 days) of detached uredospores occurred at 3° and humidity of 25 per cent. Humidity showed its greatest effect on survival between 12° and 27°. At —15° the life of the uredospores did not exceed 56 days. On agar, uredospore longevity ranged from 18 days at 3° to 30 minutes at 36°, while on wet leaves uredospores exposed to 27° were nearly all dead after 24 hours. Age of the leaf did not appear to affect susceptibility. It was found that uredospores cause infection only on leaves, penetration occurring only through the lower surface. Sporidia, however, produced aecidial lesions on both leaves and young stems.

It would seem that the reason the disease is not serious in the eastern United States is the combined effect of the cold winter and the hot midsummer. The short life of the uredospores makes the survival from one growing season to another dependent on the teleutospores. It is postulated that the prevalent high temperatures from June to September slow down the spread of the rust but do not eliminate well-established infections.

In southern California, temperature conditions are uniformly favourable to the disease. Here the decisive environmental factor is, probably, the amount and distribution of rainfall, dew and fog being of some importance during months of low rainfall. As winter defoliation remains incomplete, susceptible leaves are present at all times. The uredo stage is probably the chief source of inoculum in spring.

Baker (K. F.) & Thomas (H. Earl). **Failure of bud and graft unions of Rose induced by Chalaropsis thielavioides.**—*Phytopathology*, xxxvi, 4, pp. 281–291, 2 figs., 1946.

These writers' preliminary account of the failure of rose bud and graft unions caused by *Chalaropsis thielavioides* in California [*R.A.M.*, xxi, p. 19] has been amplified, and the following additional items of information may be noted. Strong circumstantial evidence is available for the spread of the pathogen on the hands or clothing of workers and on the budding knife. It survives in the soil or on buried plant residues for nearly a year. Graft failures may be avoided by the use of budded roses, healthy rootstocks, sanitation of tools, frames, and the like, and chemical treatment of the stems before grafting where the importance of the disease warrants it. Bud failures, which are rare, are preventable by immediate planting of cuttings or storage at 0° C. if delay is necessary, rotation with an immune crop, use of immune Ragged Robin rootstocks, high budding into canes later converted into cuttings, and precaution against spread by workmen. Chemical treatment of the cut surfaces was injurious to the host tissues.

Marchionatto (J. B.). **Argentine Republic. Tulip fire 'Botrytis tulipae', a disease new to the country.**—*Int. Bull. Pl. Prot.*, xv, 7–8, p. 133 M, 1941. [Received July, 1946.]

Studies on tulip fire (*Botrytis tulipae*) [*R.A.M.*, xxi, p. 139; xxiv, p. 231] first discovered in the Argentine Republic by Maria D. Campi showed that when the soil is inoculated with the mycelium and sclerotia of the fungus the bulbs are attacked; resting spores formed in the bulbs transmit the disease from one crop to another. Brief directions are given for the control of the disease.

Gregory (P. H.) & Gibson (G. W.). **The control of Narcissus leaf diseases. III. Sclerotinia polyblastis Greg. on Narcissus tazetta var. Soleil d'Or.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 40–45, 1946.

The object of these experiments at the Scilly Isles Experiment Station, St. Mary's, was to determine the possibility of using Bordeaux mixture for the control of narcissus fire (*Sclerotinia polyblastis*), the chief fungus disease of *Narcissus tazetta* varieties, which are grown commercially in the open in south-west England. During the seasons 1937 to 1941, Bordeaux mixture (4–4–40) with a wetting agent, usually agral II at 6 oz. per 40 gals. [*R.A.M.*, xxiii, p. 449], was applied at the rate of 120 gals. per acre on one commercial field and on small plots of the Soleil d'Or variety. One or two sprays were given annually, the first after flower-harvesting, and the second, when possible, about a month later.

The number of flowers picked on sprayed plots showed an average increase for the three seasons of 26 per cent. and increased bulb weight of 35 per cent. over the controls. The sprayed plots maintained a higher general level throughout the experiments, although the benefits recorded in any one year appear to have been exhausted in the promotion of increased flowering the year after. An average addition of one 'bell' to the inflorescence is regarded as evidence of better quality due to the treatment, and the total number of bulbs of flowering size was increased by about 15 per cent. in 1941 after only one post-flowering spray had been applied the previous year.

No marked retardation of anthesis was noted, as had been found for Golden Spur [ibid., xx, p. 206]. This method of controlling *S. polyblastis* wherever prevalent is, therefore, recommended for the Soleil d'Or variety as likely to increase production without delaying flowering.

Pape (H.). **Fäulnis bei Calla-Ursache und Bekämpfung.** [*Calla* rot—cause and control.]—*Blumen- u. PflBau ver. Gartenwelt*, xlvii, 20, pp. 235–236, 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, p. 42, 1944. Received March, 1946.]

Bacillus [*Erwinia*] *aroideae* and *B. carotovorus* [*E. carotovora*] were identified as the agents of a rapidly destructive soft rot of *Zantedeschia aethiopica* [*R.A.M.*, xx, p. 451] in Germany, which may originate in infested soil or on bulbs from abroad and be disseminated in the process of watering. The decay extends upwards from the site of invasion, just below soil-level, to the leaves and pedicels and downwards to the bulb. Control measures should include stringent sanitation and steam or formalin sterilization of the soil before planting with new bulbs.

Pape (H.). **Die Sclerotinia-Stamm- und Blattfäule der Gloxinien.** [The *Sclerotinia* stem and leaf rot of Gloxinias.]—*Blumen- u. PflBau ver. Gartenwelt*, xlvi, 14–15, p. 86, 3 figs., 1942. [Abs. in *Neuheiten PflSch.*, xxxv, 1–2, p. 14, 1946.]

Sclerotinia sclerotiorum attacks gloxinias planted out in the greenhouse for corm production towards the end of the growing period, when the dense vegetation promotes the spread of the pathogen. Symptoms of the disease include wilting of the plants in groups and a soft rot of the stems, petioles, pedicels, and the adjoining areas of the leaf blade, which are covered with the white, flocculent mycelium of the fungus, bearing the pea-sized, grey to black, sessile sclerotia. These organs fall to the ground, where they may persist for years, being highly resistant to cold and drought, before producing apothecia. The corms are not infected but suffer from the premature decay of the aerial system. Control may be effected by the use of formalin-sterilized soil, wide spacing, avoidance of excess humidity, and irrigation of the gaps left by the removal of diseased plants with a solution of 1 to 2 per cent. uspulun or of 30 gm. copper carbonate + 0·3 l. commercial sal volatile in 10 l. water.

Lepik (E.). **Spread of Snapdragon rust in Europe.**—*Int. Bull. Pl. Prot.*, xv, 5, p. 93 M, 1941. [Received July, 1946.]

Antirrhinum rust (*Puccinia antirrhini*) [*R.A.M.*, xxiii, p. 80; xxiv, pp. 475, 476] is stated to have become common in central and western Europe. In 1937 it was observed simultaneously in Leningrad, the Caucasus, Odessa, and Voronezh, though quarantine measures had been taken against it and the import of snapdragon seed was virtually nil.

Gréen (S.). **Peronospora antirrhini (Schroet.) första gången påträffad i Sverige.** [*Peronospora antirrhini* (Schroet.) encountered for the first time in Sweden.]—*Agri. Hort. Genet.*, i, 3–4, pp. 97–98, 1943. [German and English summaries. Received July, 1946.]

In a greenhouse at the Weibullsholm Plant Breeding Institute, Landskrona, in January, 1943, the writer detected the mildew *Peronospora antirrhini* on snapdragon (*Antirrhinum*) [*majus*: *R.A.M.*, xxiv, 451], this being the first record of its occurrence in Sweden. A new variety, *Antirrhinum* No. 1174, proved to be resistant to the pathogen. The wild alternate host, *A. orontium*, does not occur in the surrounding country, so that the origin of the sporadic outbreak remains obscure for the present.

Bontea (Vera). **La flétrissure de l'Aster sinensis L. (syn. Callistephus sinensis Neer.).** [Wilt of *Aster sinensis* L. (syn. *Callistephus sinensis* Neer.).]—*Bull. Sect. sci. Acad. roum.*, xxv, pp. 179–184. 1942. [Abs. in *Neuheiten PflSch.*, xxxvii, 5, p. 166, 1944. Received March, 1946.]

China asters, particularly the white varieties, sustained heavy damage in Rumania in 1938 and 1942 from the wilt disease caused by *Fusarium oxysporum* f. 6 [*R.A.M.*, xvii, p. 247], the losses in some cases amounting to 50 per cent. of the crop. In regions with a warm, humid summer climate, and where liberal applications of nitrogenous manures are given, the reduction in stand may rise to 80 per cent., elsewhere it is commonly round about 30 per cent. Lime- or phosphorus-containing fertilizers should therefore be substituted for nitrogen and peat for compost. Essential precautions are soil sterilization and half an hour's immersion of the seed in 0·25 per cent. uspulun or the same period in water heated to 35° C., followed by another 30 minutes in 0·1 per cent. mercuric chloride.

Hey (A.). **Die wichtigsten Krankheiten und Schädlinge im Samenbau der Kleeartigen Pflanzen.** [The most important diseases and pests in relation to seed production by plants of the Clover family.]—*Veröff. GemeinschArb. Forsch-Dienst. Reichsverb. PflZucht*, iii, 8, 139 pp., 45 figs., 3 diags., 1945.

This useful compendium contains the available information on the symptoms, effects, and control of a number of diseases responsible for reductions in the seed crops of various Leguminosae in Germany [*R.A.M.*, xxiii, p. 22], either by (1) weakening the plants, (2) causing their partial or total dying-off, or (3) directly attacking the inflorescences and fructifications. Group (1) includes the bean and pea mosaic viruses on clovers and the lucerne mosaic virus on its own host; the rusts, e.g., *Uromyces trifolii* and its vars. *hybridi* and *repentis* on red, alsike, and white clovers, respectively; *U. anthyllidis* on wound clover (*Anthyllis vulneraria*); *U. onobrychidis* on sainfoin (*Onobrychis sativa*); *U. flectens* on white, strawberry (*Trifolium fragiferum*), alsike, and crimson clovers; *U. striatus* on *Medicago lupulina* and more rarely on lucerne; and *U. euphorbiae-corniculatae* on *Lotus corniculatus* and *L. uliginosus*, the two last-named rusts being heteroecious, with their aecidial stages on *Euphorbia cyparissias*; sooty blotch (*Dothidella cymadothea*] *trifolii* [ibid., xiv, p. 367] on red, white, and alsike clovers and *T. medium*;

Pseudopeziza trifolii on red, white, and alsike clovers, *A. vulneraria*, and *L. corniculatus*, and *P. medicaginis* on lucerne and *M. lupulina*: leaf spots, including *Macrosporium* [*Stemphylium*] *sarciniforme* on red clover and lucerne, occasionally affecting crimson clover; downy mildews caused by *Peronospora aestivalis* on lucerne and less frequently on *M. lupulina*, *P. pratensis* on red and crimson clovers, *P. trifolii-hybridi* on alsike, *P. meliloti* on *Melilotus* spp. [all these species are often called *P. trifoliorum*], and *P. lotorum* on *L.* spp.: the true mildew, *Erysiphe martii* [*E. polygoni*], with its formae speciales on red, alsike, and crimson clovers, and to a lesser extent on white clover, *A. vulneraria*, *O. sativa*, *L.* spp., and *M.* spp. and *E. pisi* f.sp. *medicaginis* on lucerne, *Medicago media*, and *M. falcata*: and crown wart of lucerne (*Urophlyctis alfalfae*) and of red, white, and alsike clovers and *L. corniculatus* (*U. trifolii*).

Representatives of group (2) include the damping-off fungi, notably *Pythium debaryanum*, chiefly affecting lucerne but also pathogenic to crimson clover and most of the other *T.* and *L.* spp.: violet root rot (*Helicobasidium crocorum*) on lucerne, different kinds of clover, *M. lupulina*, and serradella (*Ornithopus sativus*); another root rot, caused by *Thielavia* [*Thielaviopsis*] *basicola* on red and crimson clovers and *Onobrychis sativa*; clover rot (*Sclerotinia ciborioides*) [*S. trifoliorum*], the agent of intensive damage, especially to red and crimson clovers and *M. lupulina* [ibid., xxiii, p. 22]; and anthracnose of red and crimson clovers due to *Gloeosporium caulivorum* [*Kabatiella caulivora*], and of lucerne and *Ornithopus sativus* caused by *Colletotrichum trifolii* [ibid., xxii, p. 314].

Group (3) includes the last-named and *Botrytis anthophila*, which converts the anthers of red clover into a grey, pulverulent mass without inducing any symptoms in the rest of the plant. It predominates in eastern Europe, more especially in Poland, the Baltic Provinces, and the U.S.S.R. [ibid., xix, p. 415].

A bibliography of 76 titles and a key for the determination of the diseases and pests are appended.

SCHENKER (P.). **Kleekrebspilze.** [Clover canker fungi.]—*Mitt. naturf. Ges. Bern.*, N.F., iii, pp. xxiv–xxv, 1946.

(*Sclerotinia trifoliorum*) [see preceding abstract] was the principal agent of winter-killing of red clover in Swiss experimental plots in 1944: of the two other fungi causing similar symptoms, *Typhula trifolii* was represented by numerous fructifications but only two specimens of *Mitrula sclerotiorum* [*R.A.M.*, xviii, p. 299] were detected. The isolated lucerne plants growing up among the clover remained free from infection.

MAIER (W.). **Über das Vorkommen einer Bormangelkrankheit der Äpfel in Deutschland.** [On the occurrence of a boron deficiency disease of Apples in Germany.] —*Phytopath. Z.*, xiv, 5, pp. 613–628, 13 figs., 1944. [Received August, 1946.]

The symptoms of a disease of Osnabrück Renette apple fruits in the Ulm district of Germany investigated by the author in 1940 were characteristic of 'drought spot' [internal cork], as described by McLarty from Canada [*R.A.M.*, xix, p. 603]. They included, in an early stage of fruit development, the brown discoloration and necrosis of large portions of the flesh or the occurrence in the latter of numerous pit-like, brown, necrotic areas. In both cases the fruits were abnormally small, with dark depressions in the skin, and a bumpy or irregular, undulating surface. Another form of the disorder was manifested by necrosis of the tissues surrounding the core, while some of the fruits were malformed, with deep fissures and cracks and scabby skin.

Numerous analyses revealed a substantially lower boron content in the diseased as compared with the sound fruits (10 to 25 and 40 to 150 mg. per kg. dry matter, respectively). The incidence of the trouble was reduced from 76·3 to 1·5 per cent.

in 1940 and 1941 by the injection of boric acid and borax (liquid and solid) [in unspecified quantities] into the branches of affected trees. In other tests from 1941 to 1943, borax, in powder form in the first two years and as sludge in the third, was inserted into the soil at a depth of 30 to 40 cm. at the rates of 500, 250, and 1,000 gm. in the three successive years for a large tree and at 250, 250, and 600 gm. for a smaller one, resulting in a reduction of drought spot from between 34 and 70 per cent. to nil.

STAHEL (M.). **Die Krebskrankheit unserer Obstbäume, ihre Ursachen und Bekämpfung.** [The canker disease of our fruit trees, its causes and control.]—*Schweiz. Z. Obst- u. Weinb.*, lv, 15, pp. 285–291, 5 figs., 1946.

Nectria galligena is widespread in Switzerland, about a third of the apple varieties listed in a new book by H. Kessler, 'Die Apfelsorten der Schweiz', being described as susceptible to the disease. Cultural practices indirectly predisposing the trees to infection include the excessive use of stable manure and unduly drastic pruning, both of which promote a luxuriant growth habit detracting from winter-hardiness and enabling the pathogen to enter the host through cortical fissures due to frost. Susceptibility to cold is also enhanced by heavy, impermeable, water-logged soils, notably in the Berner Rose, Sauergrauech, Golden Pearmain, Ontario, and Champagne varieties. In an orchard on ground of this description the writer in 1945 observed no essential difference between the symptoms on the Bohn and Aargauer Jäger varieties, which are classed as slightly and very highly susceptible, respectively. However, an examination of cankers of comparable age and size on both varieties revealed only scattered perithecia on Bohn, whereas on Aargauer Jäger they were so densely clustered as to impart a red sheen to the infected parts.

In addition to rational cultural practices, the most important control measure is the use of resistant stocks for grafting.

N. galligena is occasionally found on pears [*R.A.M.*, xxv, p. 399] and more rarely still on stone fruits.

MOORE (M. H.). **Improving the field performance of standard protective fungicides. I. The place of spreaders in the spray programme for Apple trees.**—*J. Pomol.*, xxii, 1–2, pp. 76–91, 1946.

The author describes a series of experiments undertaken during the period from 1932 to 1944. They were designed to test the effect of combining insecticidal and fungicidal sprays for the control of apple scab [*Venturia inaequalis*] and sawfly [*Hoplocampa testudinea*] and to reconcile the two different types of spraying; that is, the heavy insecticidal spray with a low surface-tension spreader which gives a thorough drenching of the tree, and the protective fungicidal application, which demands a concentrated spray fluid of high surface tension, dispersing in fine, misty drops and possessing good adhesive properties.

The general conclusions arrived at were that heavy spraying was superior to light spraying for scab control but it caused more damage, which could be reduced by decreasing concentrations of lime-sulphur. The use of a spreader with lime-sulphur gave improved control in one experiment only when a heavy application was made where infection had already started. The reduction in spray damage obtained when a spreader is used can be secured more economically by using more dilute lime-sulphur. Effective control of *V. inaequalis* has been obtained with as low as 1 per cent. for pre-blossom applications [*R.A.M.*, xvi, p. 765; xviii, p. 461], but a precisely timed and thorough application is required, and lead arsenate must not be incorporated. Not more than a fortnight should be allowed to elapse between applications so that constant protection is afforded.

Bordeaux mixture is not satisfactory for apples and the addition of spreaders in general proved damaging. The improvement in the fungicidal efficacy of colloidal

sulphur observed when a spreader was used does not appear to be great enough to warrant the increased expenditure where high pressure is available and scab control is the sole object in view. Damage from heavy applications is unlikely where colloidal sulphur is used alone, except for sulphur-susceptible varieties.

It is concluded that there is no objection to applying fungicides and contact insecticides together in the same spray with a good spreader. However, adequate pump capacity and high pressure should make a spreader unnecessary, although desirable perhaps in exceptional cases. It was noted that the use of ester salts and sodium B sulphonates with lime-sulphur, and of soap solution with colloidal sulphur, caused damage, and the fungicidal value of lime-sulphur was reduced by gelatine. Soap may be regarded as superseded by several of the new textile wetting agents, which are both efficient spreaders, easily prepared, and compatible with fungicides.

KHRISTOV (A.). Принос към проучването на червените петна по сливата—**Polystigma rubrum (Persoon) de Candolle.** II. Условия за узряване на стромите на паразита и възможности за прилагание на културни марки срещу болестта. [Studies of red leaf spot disease of Plum—*Polystigma rubrum* (Persoon) de Candolle. II. Conditions governing stromatal development of the pathogen and the use of cultural methods in combating the disease.] —*Земедел. Наук., България* [*Agric. Sci., Bulgaria*], i, 2, pp. 23–32, 1946.

In this study of the red leaf spot disease of plums (*Polystigma rubrum*) [*R.A.M.*, xvi, p. 392], the author found that premature abscission of the leaves, due to acute infection, depressed the vitality of the stromata and influenced the degree of infection during the following growing season. Stromata which have not overwintered do not mature; 10 weeks' low-temperature humidity is required for their full development. Ploughing-under of the fallen leaves does not kill the stromata, which will mature in early spring and induce infection if exposed on the surface of the soil by the next ploughing. If, however, they remain buried, they die before spring. Therefore, orchards ploughed during the dormant season should not be re-ploughed during the following growing period. Lime amendments to orchard soil had no effect on the stromata, but sulphur, stable dung, or potassium fertilizers impaired their vitality. Treatment with bonemeal or green manure contributed to eliminate stromata from the subsoil. Stromata wintering on the soil surface are weakened by foliage sprays of 1 per cent. Bordeaux mixture, iron sulphate, or 10 per cent. sulphur solution, applied in autumn before leaf-fall, and subsoil stromata are killed. One per cent. borax is lethal even to those on the surface. The ascospores being the sole source of infection, such treatments should reduce the incidence of the disease considerably in the following season.

GOIDÀNICH (A.). **Interpretazione simbiotica di una associazione mico-entomatica gallare.** [Symbiotic interpretation of a myco-entomogenous gall association.] —*Atti Accad., Torino*, lxxvi, 2, pp. 208–221, 3 figs., 1941. [Received July, 1946.]

Ischonyx pruniperda (Cecidomyidae), which in the larval stage transforms into galls the reproductive and vegetative buds of plums, damsons, *Prunus spinosa*, *P. cocomilia*, and *P. myrobalana* [*P. divaricata*], has been found in a symbiotic association with a species of *Sphaeropsis*. The partnership is mutually beneficial, the insect receiving nutriment from the mycelium of the fungus, and the latter feeding on the wall of the gall; both form their reproductive stages simultaneously, the insect larva serving as a vehicle for the fungus in the production of a new gall. The third member of the association, the phanerogamic host, is the only one to sustain injury.

Willison (R. S.). **Peach blotch.**—*Phytopathology*, xxxvi, 4, pp. 273–276, 1 fig., 1946.

'Blotch' is the name assigned to a mosaic-like condition observed in 1940 on a single three- to four-year-old peach tree of an unknown large-flowered variety in a two-square-mile block near Winona, Ontario. The variegations consisted of well-defined, pale to yellowish-green areas of variable size and shape, ranging from numerous angular spots scattered over the leaf blade to larger, usually fewer, irregular blotches. A few leaves showed chlorosis along the larger veins only, and in some cases the margins were ragged as a result of marginal scorch.

In transmission trials by the double-budding inoculation technique [*R.A.M.*, xxiv, p. 197], using peach, myrobalan (*Prunus cerasifera*) [*P. divaricata*], and *P. mahaleb* as stocks, Elberta and Rochester were the most susceptible of the peach varieties tested. The symptoms on the former closely resembled those on the original tree, while the latter developed a quasi-symmetrical chlorotic blotch centred about and extending along the midrib and tending to feather out along the lateral veins. Vedette showed slight blotching in some seasons, while in others little or no trace of the disorder was apparent. Golden Jubilee was practically symptomless, apart from a mild mosaic pattern or veinal chlorosis. The white-fleshed Peregrine variety, imported from England, was likewise virtually free from outward manifestations of the disease. The markings on all varieties were either pale green, yellowish-green, or greenish-yellow, never white, and no signs of infection were observed on the flowers or twigs.

The results of two seasons' transmission experiments on plums, apricots, and cherries were uniformly negative, except for one case of doubtful and indeterminate symptoms on an Italian prune.

In 1944, sucker growth near the crotch of a Marigold peach near Hamilton, Ontario, developed blotch symptoms predominantly of the central, symmetrical, feathery type, this being presumably the second spontaneous occurrence of the disorder. Transmissibility was demonstrated by the inoculation of peach seedlings, but the effects of the virus on other hosts have yet to be investigated. Another problem requiring further elucidation is the interrelationship, if any, between blotch and two rather similar disturbances, mottle and calico [ibid., xxi, p. 27; xxiv, p. 65].

Louw (A. J.). **Green rot of Apricots.**—*Fmg. S. Afr.*, xxi, 5, pp. 308, 312, 1946.

A green rot of apricots, now reported from the south-western districts of the Cape Province, where it has not been encountered hitherto and which, while familiar for many years in western Cape Province, has apparently not been recorded in the literature, causes decay of the fruit, usually originating from the calyx end, where the old sepals of the blossom adhere to the fruit. A white mould develops on the surface, the fruit ultimately shrivels, and becomes gummed to the twig unless it abscisses prematurely.

The disease is stated to be of fungal origin [unspecified], occurring sporadically, and has not occasioned serious loss hitherto in the winter-rainfall area. The present sudden and virulent outbreak is attributed to heavy rains last September and October and districts west of the south-western area of the Province escaped it, apparently owing to strong, dry, south-east winds which passed over them at that time.

Year-old twigs are also attacked by the fungus, which causes gum to exude freely and a die-back of the tips. The twigs are thought to constitute the chief source of infection. Care should be taken not to confuse the symptoms of gum exudation with similar symptoms associated with other apricot diseases, such as gum spot, in which the spots are plainly delineated on the shoots, fruits, and leaves, or the physiological accretions of gum on the older branches of apricot trees.

The following measures are recommended for the control of the disease: removal and burning of infected twigs and mummified fruits at pruning-time with a view to preventing the overwintering of the causal pathogen; spraying with 4–4–50 Bordeaux mixture when the buds begin to swell, but before exposure of any parts of the blossoms or leaves; and with 2–2–50 at about 75 per cent. petal-drop, with a repetition at the same concentration a fortnight after.

PRENTICE (I. W.) & HARRIS (R. V.). **Resolution of Strawberry virus complexes by means of the aphis vector Capitophorus fragariae Theob.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 50–53, 1 pl., 1 diag., 1946.

The authors describe experiments to determine whether the frequent association of crinkle with yellow edge or with xanthosis (possibly identical with the latter) in strawberry plants [*R.A.M.*, xxi, p. 380] is obligate or fortuitous [see next abstract]. As strawberry viruses are not sap-transmissible, nor present apparently in expressed sap, have few known vectors, and a very limited host range, a method has been devised for separating the component viruses from mixtures present in the plants based on their differential persistence in the aphid vector (*Capitophorus fragariae*). Virus-free aphids after fasting for 18 hours, although prefasting was later found to have no effect [cf. ibid., xvii, p. 344], were placed on detached leaves of Royal Sovereign plants infected with mild or severe crinkle or yellow edge. After feeding periods of two minutes, one hour, or 24 hours, two aphids were transferred to each of several young virus-free wild strawberry (*Fragaria vesca*) plants, and retransferred to similar plants after 10 minutes, two hours, and 24 hours. Chlorotic speckling, distortion, and dwarfing of the leaves were observed some three weeks later only on plants infected by aphids having a 24-hour feed. Royal Sovereign plants, whether infected by direct aphid transfer or by grafting to infected *F. vesca* plants, developed only insignificant chlorotic spotting and sometimes showed no symptoms at all, so that infection had to be confirmed by grafting to healthy wild strawberry plants.

The symptoms from all three sources of infection were similar and identical with those of mild crinkle as described by Harris and King and the virus thus selectively transmitted is provisionally regarded as mild crinkle virus. Transmission occurred after feeding periods of one hour or more and the virus did not usually remain in the vector for more than three hours.

PRENTICE (I. W.). **Resolution and synthesis of virus complexes causing Strawberry yellow-edge.**—*Nature, Lond.*, clviii, 4001, pp. 24–25, 1946.

Feeding experiments with aphids (*Capitophorus fragariae*) [see preceding abstract] have brought about the isolation of a non-persistent virus which is believed to be mild crinkle virus. Further experiments in which the aphids, after feeding for ten days on yellow edge-infected Royal Sovereign plants, transferred to uninfected plants of *Fragaria vesca* for 24 hours and again to similar plants 24 hours later, produced in the second set of plants chlorotic spotting and slight leaf-cupping. This virus, which persists in the vector for several days, transferred to healthy Royal Sovereign plants causes very mild yellow-edge symptoms and is called provisionally the 'mild yellow edge virus'. The grafting of a Royal Sovereign plant with mild crinkle to one containing mild yellow edge induced severe yellow edge in both. Thus, it appears that yellow edge is due to the combined action of two viruses, the persistent one being, apparently, different from the more persistent of two viruses isolated by Wood and Whitehead (in the Press) from plants affected with severe crinkle. The author also has isolated a persistent virus, probably identical with this, from plants with severe crinkle. The combination of this virus with mild yellow edge also produces severe yellow edge. Therefore two different types of yellow edge have been synthesized by the combination of the mild

yellow-edge virus with either the mild crinkle virus or with the severe crinkle virus.

Prentice (I. W.), King (Mary E.), & Harris (R. V.). **Experiments on virus degeneration of Huxley Strawberry.**—*J. Pomol.*, xxii, 1–2, pp. 111–116, 1 pl., 1946.

The grafting of two healthy Huxley strawberry plants to Royal Sovereign plants infected with yellow edge and crinkle at East Malling Research Station in 1938 was followed by loss in size, vigour, and leaf lustre of the plants and a progressive chlorosis of the younger leaf margins—symptoms of a condition popularly known among growers as 'degeneration'. The disease thus resembles yellow edge [*R.A.M.*, xii, p. 519, and preceding abstracts], but Huxley has been shown to be tolerant of yellow edge, and acts as a symptomless carrier [ibid., xxi, p. 379]. A similar condition has been noted on the Oberschlesien and Madame Lefebvre varieties.

Grafting experiments showed that symptoms of degeneration were induced in clones of Huxley infected with yellow edge and mild crinkle by grafting them to Royal Sovereign also infected with yellow edge and mild crinkle, suggesting the passage of a virus or viruses from the latter variety to the former. Evidence from a small number of grafts indicated that degeneration is not caused by mild crinkle.

In further field experiments Huxley plants grafted to degenerate Huxleys became degenerate and those grafted to vigorous remained vigorous. Degenerate Huxleys induced symptoms of yellow edge in Royal Sovereign plants but the symptoms were no more severe than those induced by one of the vigorous Huxley clones (infected with yellow edge of moderate severity). The relationship between degeneration in Huxley to yellow edge in Royal Sovereign is not clear, but it is considered unlikely that the virus or virus complex causing degeneration in Huxleys is distinct from the causal agent of yellow edge in Huxley or Royal Sovereign. Grafting of vigorous Huxley to Royal Sovereign plants already infected with yellow edge increased the severity of the symptoms.

The disease also has affinities with the stunting disease [ibid., xxi, p. 30], characterized by short, erect petioles, small, cupped leaves with a dull upper surface, and, occasionally, marginal chlorosis. The greenish-yellow chlorosis of degeneration may be confused with the yellower and more vivid chlorosis of *Verticillium* [*dahliae*], which is a common pathogen of Huxley and the mycelium of which can be easily isolated [ibid., xvii, p. 689].

Pending identification of the organism or organisms involved, it is recommended that runner beds of Huxley should be rogued for degeneration.

Chowdhury (S.). **Ceratostomella diseases of Pineapple.**—*Indian J. agric. Sci.*, xv, 3, pp. 135–139, 1 pl., 5 figs., 1945.

Of the three types of pineapple infection by *Ceratostomella paradoxa* [*R.A.M.*, xix, p. 663] in the Surma Valley and hill districts of Assam, namely, leaf spot, base rot, and fruit rot, the first-named was found, during a survey from 1940 to 1944, to cause negligible damage, while the other two were responsible for losses of 4 to 10 and 3 to 15 per cent., respectively. Fruit rot was particularly troublesome in transit and storage on the local Joldhup variety, the crop of which was occasionally reduced by over 50 per cent.; the imported Giant Kew and Queen were more resistant. The symptomatology, pathogenicity, morphological and cultural characters, and means of perpetuation and dissemination of the fungus are described.

Chowdhury (S.). **Heart or stem-rot of Pineapple.**—*Indian J. agric. Sci.*, xv, 3, pp. 139–140, 1 pl., 1945.

Heart or stem rot of pineapple (*Phytophthora parasitica*) occurs in a highly sporadic form in the Surma Valley and hill districts of Assam, some fields losing

7 to 25 per cent. of their plants from partial or complete destruction of the meristematic tissue and others none. The disease has not hitherto been reported on pineapple from any other part of India, though it is prevalent in other countries. The pathogenicity of the fungus was established by inoculation experiments. In addition to thorough drainage of the soil and the exclusive use of vigorous planting material, Mehrlich's recommendation in *Pine Quart., 1931*, 1, pp. 171–182, 1931 of immersion in Bordeaux mixture 1–1–3 before planting [cf. *R.A.M.*, xii, p. 304] gave satisfactory control.

DUBRISAY. **Propriétés et étude des produits mouillants. Théorie élémentaire du mouillage.** [The properties of and a study on wetting products. An elementary theory of wetting.]—*C.R. Acad. Agric. Fr.*, xxvii, 13, pp. 746–752, 1 fig., 1941. [Received August, 1946.]

The author discusses the phenomena of surface tension and their application to the testing and employment of wetting compounds.

RAUCOURT (M.). **Revue de phytopharmacie. VII^e^ série.** [Review of phytopharmacy. 7th series.]—Reprinted from *Ann. agron.*, 19 pp., 1943. [Received August, 1946.]

In this paper the author reviews and discusses, with numerous references to the relevant literature, recent advances in the study of insecticides and fungicides under the headings biological methods, sulphur and its derivatives, work on arsenicals, organic products of synthesis, and adjuvants. A list of 85 papers cited is appended. Practically all the work referred to on fungicides has been noticed from time to time in this *Review*.

MARSAIS (P.). **Toxicité du cuivre et mode d'action sur les parasites végétaux.** [The toxicity of copper and its mode of action on plant parasites.]—*C.R. Acad. Agric. Fr.*, xxviii, 2, pp. 162–169, 1942. [Received August, 1946.]

From a study of 70 papers printed before 1917 and 30 between that year and 1941, inclusive, the author summarizes under 10 headings the state of knowledge [at the date of writing] on the causes and mechanism of the toxicity to plant parasites of preparations containing copper.

The points dealt with are the following. (1) Copper, acting through the ions liberated from dissociated solutions, kills, in the form of its dissolved salts, at a dosage of 10^{-6}, the zoospores of mildew [? *Plasmopara viticola*] or, at least, prevents them from developing. In this form it breaks the life-cycle of the parasite. (2) In practice, the dosage adopted is about 10^{-2}. (3) The idea of the threshold of toxicity is somewhat shaken by the phenomena of adsorption. (4) It is only for copper that the toxic value of the insoluble salts has been studied; with the other metals, only the action of the soluble salts and that of salts in suspension have received attention. In any case, toxicity is related to the presence of free metallic ions, and, seemingly, to their valency and atomic weight. (5) The very toxic salts of silver, mercury, and copper are very soluble or highly dissociated. The copper salts present in the deposits left by mixtures, mostly insoluble, contain enough copper ions, which can be freed, to be toxic to the zoospore. Possibly, insoluble copper compounds act mechanically or physically on the zoospore. If the intervention of electrical phenomena is taken into account, consideration must be given to Delage's view that the copper ion, positively charged, is emitted by insoluble particles which are negatively charged. The peripheral zone of the zoospores, negatively charged, at first repels the particles, but finally attracts the ions and fixes them by adsorption. With the salts of mercury and silver, it is the free positive ions Hg and Ag which act; colloidal silver is much less toxic than

dissolved salts of silver, and is charged with negative electricity. Colloidal copper oxychloride is more fungicidal than the deposits from copper mixtures, and is positively charged. (6) A different explanation is given by Devaux: the surfaces of spores and plants are charged with positive electricity and attract free or semi-free, negatively charged molecules. (7) The aqueous part of plants is surrounded by the cell membrane; this membrane appears to attract the least hydrated part of the neighbouring free molecules; the copper salts of mixtures are much hydrated, and can be adsorbed by their metallic content. (8) It appears that a strong charge brought about by the electrolytes serves to establish the necessary relations between the living membranes and the copper particles, and this enables these particles to act, whether their charge is positive or negative. (9) The question arises whether the copper ions, if they are adsorbed, act chemically within the spores upon the metabolism of the plant-host. More information is required to clear up this point. (10) The meaning generally applied to the term 'toxicity' should be extended to include excess or deficiency of certain bodies, or electrical charges.

Ciferri (R.). **Recenti progressi italiani nel campo degli anticrittogamici.** [Recent Italian advances in the field of fungicides.]—*Atti Conv. agrar. italo-amer., 1946*, pp. 1–40, 1946.

In this paper, read at the Italo-American Agricultural Convention held at Florence on 25th to 29th January, 1946, the author reviews and discusses the researches carried out at the Centre of Fungicidal Studies, Pavia, during the late war. Laboratory tests of over 400 formulae containing 1 to 12 per cent. copper and of nearly 300 not containing copper, with field tests of about 100 of all these, showed that fungicides containing less than 8 per cent. metallic copper, whatever their composition, did not guarantee adequate control of an epidemic of average intensity of vine mildew (*Plasmopara viticola*). Certain materials containing 8 per cent. metallic copper showed a general fungicidal effect (and against *P. viticola* in particular) which was much greater than that of Bordeaux mixture with an equal content of the active metal (0·3–0·3–100) and sometimes approached that of Bordeaux mixture (1–1–100). Hence it appears that Bordeaux mixture (1–1–100) was not outclassed by materials manufactured during the war which contained one-third of this amount of copper. There is, however, hope that if the content of the active metal can be raised above 8 per cent. (presumably to between 12 and 16 per cent., corresponding to a copper content in Bordeaux mixture of between 0·3–0·3–100 and 0·6–0·6–100) without affecting the favourable characters of these products, when they should at least equal Bordeaux mixture 1–1–100.

As regards future studies, the most promising aspects are as follows. Among univalent fungicides, the best monometallic products are those having a copper base. Of these, the inorganic include the cuprobentonites and the improved cuproammoniacal sprays, while the organic include primarily cuprous products with a potentializing effect due to the addition of oxyquinolin derivatives and, secondarily, the cuprotartrammoniacal compounds. The polymetallic fungicides are those containing other metals beside copper, particularly iron and zinc, among the heavy metals. Among these may be mentioned the cupro-ferrocitric sprays, of which Casale's mixture [*R.A.M.*, xxii, pp. 52, 287] is the prototype, and the polymetallic bentonites, containing, in addition to copper, various other elements such as iron, magnesium, zinc, etc.

Among polyvalent fungicides mention should be made of the sulphocupric products containing polysulphides or colloidal, bentonite, or active sulphurs.

[This paper also appears in *Atti Ist. bot. Univ. Pavia*, Ser. 5, viii (1), pp. 1–40, 1946.]

KHRISTOV (A.). Начин за домашно приготовление на колоидална сяра. [Directions for preparing home-made colloidal sulphur.]—*Земедел. Наук., България* [*Agric. Sci., Bulgaria*], i, 1, pp. 1–22, 1 pl., 1946.

A useful home-made colloidal sulphur spray can be prepared from two solutions, one consisting of 1 l. glue solution (10 to 20 per cent.) added to 10 l. water, plus 0·4 l. concentrated lime-sulphur solution at 23° Baumé, and the other 30 gm. ground potassium permanganate in 10 l. water; the latter solution is poured slowly into the first, which should be well stirred meanwhile. An addition of water to this mixture to make 50 l. produces a sulphur content of 1 in 500, the preparation having an alkaline reaction of pH > 8·4, being pale ochre in colour and possessing good wetting and adhesive qualities. It should be freshly made to prevent aggregation of the sulphur particles, but 30 c.c. concentrated sulphuric acid, added until a milky-white solution is obtained, and having an acid reaction of approximately pH 4·2, as in the case of commercial sulphurs, will enable it to keep several days. Home-made colloidal sulphur proved as effective as lime-sulphur at 1 in 50 for spraying apple seedlings against mildew [*Podosphaera leucotricha*]. Jonathan apples in 1943 showed 85 per cent. of the fruit attacked by *Venturia inaequalis* in the controls, 12 per cent. on trees sprayed with cosan at 1:1,000, 11·5 per cent. at 1:500, and 5·5 per cent. on those treated with home-made colloidal sulphur.

SĂVULESCU (T.). **Rumania. Agricultural parasiticides authorized for use in the country.**—*Int. Bull. Pl. Prot.*, xv, 3, pp. 41 M–49 M; 4, pp. 67 M–73 M, 1941. [Received July, 1946.]

The fungicides and insecticides authorized for use by the Rumanian Ministry of Agriculture are tabulated and grouped according to the type of compound, the name of the product, the supplier, the disease or pest controlled, and the dose recommended being given for each. The manufacture, sale, and use of fungicides, insecticides, etc., are permitted in Rumania only if they conform to provisions laid down in Royal Decree No. 361 of 19th March, 1937, published in the *Monitorul Oficial*, i, 67, 22nd March, 1937.

DAVIES (W. H.) & SEXTON (W. A.). **Chemical constitution and fungistatic action of organic sulphur compounds.**—*Bio-chem. J.*, xl, 3, pp. 331–334, 1946.

A series of xanthic, dithiocarbamic, thiocyanic, and isothiocyanic derivatives, together with some oxygen analogues and benzthiazole derivatives, were tested for their relative toxicity to *Fusarium graminearum* [*Gibberella zeae*], *Penicillium digitatum*, *Cladosporium herbarum*, *F. caeruleum*, and *Botrytis cinerea* (the last three were discontinued in the later stages of the experiments). The lower xanthates, notably potassium methylxanthate, and certain substituted arylisothiocyanates must be regarded, on the basis of these trials, as among the most highly fungistatic synthetic organic substances known, the activity of the latter group being at least equal to that of the best arylmercuri-salts, e.g., phenylmercuriacetate, though falling short of the more powerful ethylmercuri-salts. Potassium methylxanthate inhibited the growth of *B. cinerea* and *F. caeruleum* in dilutions up to 1 in 7,807,500. Phenyl thiocyanate was active up to 1 in 62,500, also against the relatively refractory *P. digitatum*.

The recruitment and training of plant pathologists in Great Britain. A report prepared by the Plant Pests and Diseases Committee and adopted by the Council of the Association of Applied Biologists.—*Ann. appl. Biol.*, xxxiii, 1, pp. 119–123, 1946.

The Committee's recommendations [cf. *R.A.M.*, xxiv, p. 460] are, *inter alia*, for the provision of one or more plant pathology training centres directed by plant

pathologists using satisfactory laboratory and field facilities; higher standards of training in plant pathology should be required for County Officers and refresher courses provided; specialist advisers and research workers should have a degree in pure science and then attend a training centre for two years for instruction in plant pathology, husbandry, and cognate subjects and to obtain experience in research, adequate financial aid being given for this training and for maintenance of the student.

WHIFFEN (A[LMA] J.). **Aerosol OT in the preparation of microscopic mounts of fungi.**—*Mycologia*, xxxviii, 3, p. 346, 1946.

The use of one per cent. aqueous solution of aerosol OT [*R.A.M.*, xxii, p. 171] is recommended as a wetting agent for temporary mounts of fungi, having been employed successfully in mounting *Aspergilli*, *Penicillia*, Mucorales, Actinomycetes, and miscellaneous Hyphomycetes. This solution mixes easily with lactophenol.

KURTH (E. F.) & CHELDELIN (V. H.). **Feeding yeasts from wood sugar stillage.**—*Industr. Engng Chem.*, xxxviii, 6, pp. 617–619, 1946.

In a comparative study at the Oregon Forest Products Laboratory on *Torulopsis utilis*, *Mycotorula lipolytica*, and *Hansenula suaveolens*, all three yeasts gave a satisfactory performance on still waste liquors from Douglas fir [*Pseudotsuga taxifolia*] hydrolysates, little difference being observed between their growth rates, sugar utilization, yeast yield, and nutritional value [*R.A.M.*, xxv, p. 270]. When dried, the yeasts may be expected to furnish a fodder serving as an excellent source of protein, amino acids, and B vitamins, comparing favourably in this respect with the best strains of brewer's yeast [*Saccharomyces cerevisiae*]. Dry yeast yields ranging from 53 to 63 per cent. of the weight of the sugar consumed have been obtained.

Verordnungen der Regierung im Protektorate der Jahre 1941–1942 betreffs des Kartoffelkrebses (Synchytrium endobioticum). [Government Orders in the Protectorate during the years 1941–1942 relating to Potato wart (*Synchytrium endobioticum*).]—*Ochr. Rost.*, xviii, pp. 159–160, 165–166, 181–186, 1942, issued 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 3, p. 86, 1944. Received March, 1946.]

Each time potatoes are transported from a zone infested by wart disease (*Synchytrium endobioticum*) to other parts of Czechoslovakia [*R.A.M.*, xvii, pp. 500, 501, 550], the railway waggon must be disinfected with a 10 per cent. solution of formalin on completion of the journey. As from 1st March, 1945, immune varieties only are to be cultivated. Up to November, 1942, 92 communities in 13 districts had been proclaimed infested and a number of others suspected of harbouring the fungus. For a period provisionally fixed at ten years, tubers of immune varieties only may be consigned from the infested zones to certain specified areas, the cultivation therein of all other Solanaceae being prohibited and the eradication of solanaceous weeds obligatory.

HENNING (L. J.). **Departmental inspection and certification of seed Potatoes.**—*Fmg S. Afr.*, xxi, pp. 313–319, 1946.

The regulations with which potato-growers wishing to cultivate seed potatoes in apparently suitable areas under a certificate of the South African Department of Agriculture are required to comply are fully set out and cover, *inter alia*, standards for 'A' and 'B' certificates and field and tuber inspection, seed sizes, sale of seed potatoes, crop inspection for fungal, bacterial, and virus diseases, and the determination of virus diseases.